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The Brown & Sharpe Surface Grinding Machine.

Those accustomed to fitting surfaces of considerable extent by the use of the file, are aware that, where the requirements are for good work, the process is a slow and costly one, not only for the files used, but principally for the amount of skilled labor, required. The ordinary emery grinding machines, while they serve a very important end in the economy of manufacture, removing superfluous stock at a small cost, are not, of course, designed for accurate work, such as that done by the use of the fine file and stone.

The machine illustrated herewith should not be confounded with the coarse grinding machine, but is, in every respect, a finishing machine, being made with the same care as the better class of iron planers, to which, substituting the cuttting wheel for the cutting tool, it bears a close resemblance. It is designed for producing true surfaces on the soft parts of machines and machinery, as well as for truing up and fitting hardened work, such as dies, guides, chilled surfaces of cast iron, &c., for grinding straight edges, and in fact for all classes of finished machine work, doing it in a superior manner and in a fraction of the time in which it can be done by hand.

As will be seen the work to be operated upon is carried on a table, the guides of which are protected by projecting slides on the table so as to leave them unexposed at the extremes of the stroke. Motion is communicated to the grinding wheel by means of two belts, driven by a drum on the shaft directly back of the wheel. The curvature of the uprights corresponding with a portion of a circle described from the center of the drum shaft, provides for a constant belt tension with the cross-slide in any position, vertically. The machine is provided with automatic feed motion, all necessary means for rapid adjustment, and is complete with countershaft, hangers, &c. As here represented it will grind, using a 12 inch wheel, a piece 14″ wide, 10″ high and 36″ long. When desired it is made to grind pieces of greater length. It is manufactured by the Brown & Sharpe Manufacturing Company, Providence, R. I.

The discovery of extensive tin ore-bearing rocks in Alabama will enable this country again to make an effort to compete with Great Britain in the production of tin. That country may be said to have held a monopoly of that product ever since the dawn of commerce. The Phœnicians carried on a trade in Cornwall tin three thousand years ago, and this business, no doubt, had an influence on the original settlement of the British Isles. Tin ore has been discovered in numerous other localities, but not of a quality to compete successfully with that mined in Cornwall. In Saxony they made a commercial success out of tin ore that contained only one-half of one per cent. of pure tin. From the reports that reach us from Alabama, we should judge that the ore discovered there is in a condition to make it commercially valuable. It is found in a gneiss and mica formation, from which the metallic tin can be separated without an expensive process. Tin ore found in several other portions of the States is mixed with tungsten, from which it can only be separated by roasting and other tedious manipulations. The Alabama tin ore is reported to yield about 6 per cent. of metallic tin, which, if true, is certain to insure a commercial success. The district where the ore is found has excellent water-power facilities. We shall watch the development of this industry with interest, and are hopeful that it may prove an entire success.

THE BROWN & SHARPE SURFACE GRINDING MACHINE.

Railroad and Machinery Business in Nicaragua.

We have recently had a call from J. W. Metcalf, a mechanical engineer, who was in charge of railroad machine work at Managua, Nicaragua, for several years, and is about to return to that country. From Mr. Metcalf we obtained some items of interest connected with mechanical matters in Nicaragua. They have about 60 miles of railroad in running order, with headquarters at Managua, and there are 36 miles more under construction. The locomotives and cars used are all of American make, but the greater part of the construction material, including the rails, was brought from Europe. Frenchmen have the leading interests in the country, and they are striving to obtain the greater part of the trade, the English being their principal rivals. A French company brought about 800 tons of old machinery from France to Nicaragua, and valued the stuff at $300,000. With the old machinery, a great part of which was worthless, they have been trying to establish a "School of Art" near Managua. They have erected a machine shop 300 feet long by 100 feet wide, where they propose to manufacture machinery to supply the wants of the country. But they have no machinists, and scarcely any skilled workmen; so the place stands idle. To run their machinery they brought a small portable engine, and they also imported from France ten car loads of coke to be used as fuel in the boiler furnace, although the country is well supplied with first-class fire wood. The superintendent of the railroad was a ship captain, and he has recently been transferred to the position of roadmaster.

Running a Lathe.

THIRD PAPER.

BY FRANK H. RICHARDS.

I shall not venture to dictate, nor scarcely to suggest, the proper speed to run a lathe. While willing enough to express my opinion in any individual case, I would not be so rash as to lay down a general law. In our shop the lathes, from 14″ to 30″ swing, run at a speed which would give about 25 feet per minute surface travel at the largest swing of the lathe. They generally run too fast to turn average work comfortably at the full swing of the lathe, and for very heavy work, which we seldom handle, or for steel, they would run considerably too fast. Yet I have often done light cutting upon fine, soft cast-iron at 100 feet per minute, and hand-scraping still faster, and I never did more satisfactory work.

When we have determined what speed we require for our lathe, we have to compute the size of pulleys suitable to drive it, and I venture to call attention to my method of making the computation. Though an operation of simple arithmetic, the labor which some make of it would seem to invite all the labor-saving contrivances that can be applied to it.

If we have a belt from one pulley to another, the speeds of the two shafts will be inversely as the diameters of the pulleys. If we have a shaft making 150 revolutions per minute, and carrying a pulley 24″ diameter, driving a 12″ pulley upon another shaft, the speed of the latter will be 300. Let us place them in this way:

DRIVER.	DRIVEN.
150	12
24	300

If we multiply the two items in each column together—that is, if we multiply the speed of each shaft by the diameter of the pulley it carries—we have $150 \times 24 = 12 \times 300$, and this principle holds in all computations of this character; the product of the speed of the driving shaft and the pulley it carries is equal to the product of the driven pulley and the speed of its shaft.

If we have a train of belting or gearing carried through any number of successive shafts, and through which we wish to compute the speed or diameter of the last pulley, we may do it at a single operation. I can show this best by an example: Our engine makes 200 revolutions per minute. It carries a 48″ pulley, driving a 56″ pulley upon the main line; then a 36″ upon this line drives a 30′ upon the upstairs line; a 28″ upon this drives a 10″ upon the wood planer countershaft, and a 24″ upon this drives a 4½″ upon the planer. At what speed does the planer run? We place these in two columns:

DRIVERS.		DRIVEN.
Speed of engine shaft.....	200	
Pulley on engine shaft.....	48	56. Pulley on main line.
Pulley on main line.....	36	30. Pulley on upstairs line.
Pulley on upstairs line....	28	10. Pulley on planer counter.
Pulley on planer counter.....	24	9. Planer pulley—numerator.
Planer pulley—denominator...	2	—. Speed of planer.

Here the occurrence of the 4½″ pulley shows the additional convenience of our method. We make an improper fraction of it, and place the numerator in the driven column, where the pulley belongs, and the denominator in the opposite column. Any fraction occurring upon either side may be disposed of in this way. Now, the product of all the factors in the one column, if each column were complete, should be equal to the product of all the factors in the other column; and in our present example, to obtain the missing factor, we have only to multiply all the factors in the column of drivers together and divide by the product of the driven column, and the quotient will be the missing factor, the answer we require. Most of the labor of the operation is avoided by cancelling all the factors common to both sides. First, all the ciphers disappear; then $56 \div 28 = 2$, $36 \div 9 = 4$, $24 \div (3 \times 2) = 4$. This leaves no factors in the driven column. All that we have then to do is to multiply together the surviving factors of the driving column, and we have the missing factor of the driven column, the speed of the planer,

the answer we seek. Our job, when done, will look like this:

$$\begin{array}{rrr} & 200 & \\ & 48 & 56\ 2 \\ 4\ 36 & & 30 \\ & 28 & 10 \\ 4\ 24 & & 9 \\ & 2 & \text{---}\ 3072 \end{array}$$

Of course it need not be said that, instead of finding the last speed, we may by the same method, if we have that speed, find the last pulley, or any other pulley of the series, whether a driver or driven.

I offer another example which may appear rather formidable, but which is simple enough and easily handled if we only keep cool. It is the series of pulleys and gearing from our engine shaft to the platen of our big planer, to find the cutting speed of the planer in feet per minute at a single operation. The 26″ in the driven column is the pulley upon the planer; all before that are the pulleys on the several line shafts and countershafts through which the power is carried; and if any one could see the situation of our planer, they would not laugh at the number of pulleys employed. The 15 is the number of teeth in the pinion upon the planer pulley shaft; 128, number of teeth in gear upon the next shaft; and 15 again the number of teeth in the pinion upon the same shaft, which, through an intermediate gear, works into the rack of the platen. The pitch of the rack and pinion is $1\frac{1}{16}$″, or $\frac{17}{16}$; and since this would give us the result in ipches, we employ the fraction $\frac{1}{12}$ to bring it to feet. Of course, as previously explained, if the numerator belongs to one column, the denominator belongs to the other, and they are so placed:

DRIVERS.		DRIVEN.	
Speed of engine.	200		
Engine pulley...	48	54	
" " ...	26	32	
" " ...	28	28	
" " ...	18	18	
" " ...	18	20	
" " ...	20	16	
" " ...	16	26	
Teeth of pinion..	15	128.	Teeth of gear.
" " ..	15		
Pitch — numerator.....	17	16.	Pitch — denominator.
Inches to feet— numerator....	1	12.	Inches to feet— denominator.
		—.	Speed of platen.

There, when we are ready for operations, our arrangement will look like that. We then cancel wherever we can, and that simple stratagem slaughters them after this fashion:

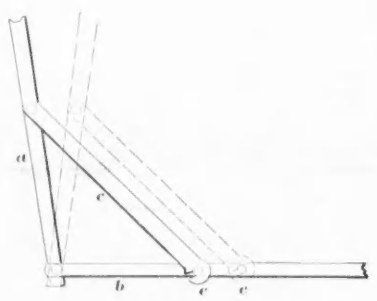
$$\begin{array}{rrr} 25\ 200 & & \\ 3\ 48 & 54\ 3 & \\ 26 & 32\ 4 & \\ 28 & 28 & \\ 18 & 18 & \\ 18 & 20 & \\ 20 & 16 & \\ 16 & 26 & \\ 5\ 15 & 128 & \\ 15 & 16 & \\ 17 & 12\ 4 & \\ 1 & & \end{array}$$

After this fun is over, we multiply together the survivors of the drivers, and divide the product by the product of the driven, and we have $(25 \times 5 \times 15 \times 17) \div (4 \times 128 \times 4) = 31875 \div 2048 = 15.56$ feet. All the dimensions given in this example are actual measurements. The figures are not always so favorable for cancellation.

When we have determined at what speed we will run our lathe, the next thing is, how shall we drive it? The shipper is an important item in running a lathe, both for the comfort and the convenience of the operator, and more attention than is usually bestowed could be profitably given to it. The primitive device of the tight-and-loose pulleys, with a separate shipper for each belt, is what I was brought up upon, and is not so bad after all. If the cone is small, so that the countershaft runs pretty fast, and the tight-and-loose pulleys as large as possible, you can handle the business quite rapidly. I remember with peculiar feelings a certain lathe in the old shop, where the ceiling was too high to use levers very comfortably. The lathe had its two shipper bars, and each shipper bar was operated by two dangling strings. The four strings hung down, with four bobs upon the ends of them, each bob of a different shape and each string of a different length, so that they should not be mistaken one for the other. It was like a feat of Japanese jugglery to run this on quick, short screw-cutting; and if a man operated it all winter he was generally able to get a job in the spring to drive the band chariot for a circus.

The tight-and-loose pulley arrangement is improved, and improved backward, and very far backward, in the countershaft that the cheap lathe-builders have the impudence to offer us, where the one shipper bar is made to shift both belts. Of course, the two belts take double as much power to ship them as a single one would take, and having to be shifted double the distance it makes a fourfold disadvantage; then, if we have the impatience of the workman for a third multiplier, it results in an octuple exasperation, and an octuple exasperation is apt to wrench the coefficient of safety all out of shape.

The tight-and-loose pulleys are discarded by the best makers, and friction clutches are substituted. These are generally all that could be desired, except that some of them require too frequent adjustment. The weight of the shipper lever in all classes of shippers is apt, when the lever is swung out of the vertical, to work it back and bring the lathe to a stand-still. In many cases the lever may be counterbalanced by continuing it upwards and fastening a suitable weight to it. On long work, years ago, I used to lock my lever by the arrangement shown in the



sketch, which I suppose explains itself. The horizontal bar is, of course, held up at its other end by another lever. I held it up by a string, but it swung back and forth in a way that I ought to have been ashamed of. The hook may be swung up against the front of the lever out of the way when it is not wanted.

There will not be a perfectly satisfactory shipper until some one shows us how to operate it from the carriage. At an interesting point in a job it is an annoyance and a hindrance to have to look up and reach up for the shipper. There are about forty possible ways of accomplishing what I want, but I think it is the forty-first I am looking for.

A brake upon the shipper would be valuable, and could be arranged very simply. For a lathe it would be best to have a special pulley on the countershaft, and a brake shoe very near the surface of it could be brought to contact by a slight movement of the shipper lever in a direction at right angles to its shipping movement. We have this on a Gould & Eberhardt shaper, and by it we can stop the tool at any point of the stroke.

I like to see a latheman get to have some kind of affection for his lathe, but his jealousy will certainly grow with his affection. No good latheman hankers to have any one else handling his lathe. Many men make it a point to keep their lathes in some respects a little "off," or awkward, for the purpose of keeping others from working on them if they happen to be away at any time. I ran a lathe for five or six years without a backing belt, cutting every kind of screw that came along quicker than I could have done with it, and without the least inconvenience. This brought me, after a while, to find a much better use for the other pulley of my countershaft, and that was to give me another change of forward speeds. A second driving speed is not merely one additional speed faster or slower, but it may be made to give us an intermediate step between each change of belt on the cone, and it is, in fact, eight additional speeds given to the lathe. Thus, in my last paper, we had a lathe back geared 16 to 1, and the cones so arranged that from, say, 5 turns, as the slowest, we doubled the speed at each successive change of belt all the way up, and the series of speeds was then 5, 10, 20, 40, etc. Doubling the speed is too much of a jump. Now, if with a second driving belt we can get $3\frac{3}{4}$ for our slowest speed, we have this for the full series: $3\frac{3}{4}$, 5, $7\frac{1}{2}$, 10, 15, 20, 30, 40, 60, 80, 120, 160, 240, 320, 480, 640.

Theory and Practice of Injectors.

BY FRANK C. SMITH.

It is frequently asserted that no satisfactory popular theory for the action of the injector has been made generally public, and to a certain extent this seems to be true. Probably the most satisfactory theory is the one based on the greater velocity of steam issuing from an opening in a boiler, than that of water under the same conditions.

This theory, as known, sets forth that if a boiler carrying a pressure of 100 pounds above the atmosphere, has an opening of one inch area through the shell in the steam space, and another similar hole in the water space, the steam, if the pressure be maintained, will flow out into the atmosphere, according to Nystrom's formulæ at a velocity of 1869 feet per second, while the water will escape at a velocity of but about 100 feet per second. It is also stated that if a stream of water having a greater velocity than 100 feet per second be directed against the opening on the water space of the boiler, it will enter, notwithstanding the opposition of the outcoming steam. When then, the injector is working—assuming for simplicity that the injector nozzle has one inch area—the stream of steam flowing from the nozzle in to the combining tube is condensed and will be reduced to a stream of water nearly $\frac{3}{32}$ of an inch in diameter, which is supposed to maintain the velocity of the stream of steam. The principle of induced currents now comes into play, and the water in the body of the injector is picked up, carried along with the fast running stream resulting from the condensation of the steam, and enters the boiler in accordance with the above stated principles.

If this theory is correct under the above circumstances, it will be seen that the stream of water $\frac{3}{32}$ of an inch in diameter, has a velocity of nearly nineteen (19) times that necessary to re-enter the boiler, and that its velocity can be greatly reduced by mixing with and carrying along a large quuantity of feed water, and still have sufficient speed to again force its way into the boiler.

Whatever the correct theory may be, it matters little to the practical users of the injector, for the authorities do not altogether agree on the mathematics of the subject, as according to one, in a supposed case, the stream of steam was capable of carrying back into the boiler 160 times its weight of feed water, while Rankine states that the expenditure of steam is about fourteen times the volume of the water injected. If we therefore suppose ten cubic feet of water to be fed to a boiler carrying 100 pounds pressure per square inch above the atmosphere, it would require a volumn of steam of 140 cubic feet. The weight of a cubic foot of steam at this pressure is .264 pounds and of the 140 cubic feet $.264 + 140 = 36.96$ pounds. The ten cubic feet of water injected would weigh 625 pounds, which gives nearly 17 pounds of water injected for one pound of steam. The difference between 17 and 160 is quite discouraging to the practical man, and it is very doubtful if a formula can be made to cover this point that would give sufficiently close results for practical purposes, owing to the many different styles of injectors in use. A practical test would be much more satisfactory to a person in search of information on this point.

Several years ago the writer was connected with a road on one of the engines of which an original Giffard injector was attached. It was nearly 30 inches long and was bolted upright to the tail casting of the running board. A hole through the backboard of the cab was provided for the engineer to thrust his hand through when he desired to use it—which, however, occurred but once, as the talent on that road was not sufficient to keep it at work for ten consecutive minutes. It was a source of wonder and mystery to all who saw it, and an unauthenticated legend existed, to the effect that a fireman had once placed his finger on the running stream which cut it off as clean as a hatchet. For several years after it was impossible to get an injector on to that road, and the memory of the upright Giffard had nearly faded away, when three contract shop engines were purchased, which were fitted with injectors. They were better than the Giffard, but not much, as to get them to work the pressure had to be reduced to about 80 pounds, the motion of the engine when running caused them to "break," and they were soon abandoned. However, the last few years have seen the injector so perfected that its superiority to the pump is no longer questioned. Tests made as far back as 1876 on the Illinois Central R. R. demonstrated that the injector was equally as reliable as the pump, more economical and better in every way. Objections are sometimes raised that an injector capable of supplying an engine, when working very hard, cannot be throttled fine enough to allow of its continuous working when the engine is working light. This may be true of some styles, but there are those in use to which these objections do not apply.

In the writers experience several 17x24 engines were fitted with injectors, and these engines were used on freight and passenger work, hauling 30 loaded freight cars, and from 5 to 7 cars on a passenger train. When on the latter with a train of 5 cars and a schedule time of 30 miles per hour, these injectors have to the writer's knowledge been working continuously for 75 miles without a change of position of the lazy cock. No pump can do better than this. The injectors referred to were "lifting injectors," and while some engineers did better with them than others at first, they all as soon as it was understood that the finer the lazy cock was worked the finer the throttle also should be handled, had equal success. Considerable trouble was experienced at first with the liming up of the nozzles, the water being so bad that six months' use would affect very badly the working of the injector. This was entirely cured by placing a self-feeding oil cup on the steam pipe of the injector, using ordinary mineral or "black" oil, and consuming about one-half pint in two days. After two years' use no deposit of lime was found. An engineer who has once used a good injector will wonder at his prejudices, fears and superstitions concerning it before he becomes acquainted with it by practical experience, and to get him to again use the pump, especially in winter, when his pump packing is ruined and blown out by the heater, the side of the engine and main rod solid with ice from the pet cock, to say nothing of the frequent necessity of thawing the latter out with a torch, or the occasional necessity of accepting "30 days" for an ice-bursted air chamber or pump barrel, would be almost impossible.

According to the London *Engineer*, there has been no instance of the explosion of the shell of a modern marine boiler. This immunity from accident is attributed to the wide margin of safety insisted on by the Board of Trade inspectors. The statement is made that, were locomotive boilers subjected to the factor of safety required of marine boilers, those now carrying 120 pounds of steam to the square inch would be reduced to a pressure of from 47 to 50 pounds.

Another rolling mill is to be built at Middletown, Pa., by capitalists of that place.

The Milling Machine—Its Construction and Uses.

By JOHN J. GRANT.

THIRTEENTH PAPER.

The end or shank cutter is a very valuable and almost indispensable tool for use with the universal milling machine. It should be made of various diameters and lengths, cut on the end as well as on the periphery. They can be used for an almost endless variety of purposes, amongst which are slab and face milling, cutting key-ways in shafts, finishing the edges of irregular-shaped pieces, cutting face or periphery cams, and other such jobs. In fact the shank cutter is the one used for nine-tenths of the operations performed on the universal machine. It is therefore of importance to the beginner that he should know how to make them of the best form for all purposes. If the straight shanks are used they will not be as difficult or costly to make. As remarked in a previous paper, the collets *must* be perfectly true, and up to $\frac{3}{4}''$ diameter, the shanks should be of the same size as the body of the cutter. Above that size the body may be enlarged, as it is seldom necessary to use a shank-cutter above $1''$ in diameter. The shank should be ground after being hardened, if there is a grinder or grinding attachment for a lathe in the shop, as this insures a perfect running cutter. On all sizes $\frac{1}{2}''$ in diameter and upwards, there should be a hole chucked in the center. This hole may be $\frac{3}{16}''$ in the $\frac{1}{2}''$ diameter cutter, and $\frac{3}{8}''$ in the $1''$ size. This will make the cutter clear itself from chips better, besides making it easier to grind and keep in order. It is necessary to make this style of cutter with finer teeth than the large cutters made to run on arbors. It may be made with the following number of teeth: $\frac{1}{8}''$—6, $\frac{3}{16}''$—6 or 7, $\frac{1}{4}''$—7 or 8, $\frac{3}{8}''$—8 or 9, $\frac{1}{2}''$—8 or 9, $\frac{5}{8}''$—10, $\frac{3}{4}''$—10, $\frac{7}{8}''$—11 or 12, $1''$—14 to 16. Cut them with angular cutters of 40°, 50° or 60°, according to the size, using the lesser angle for the small sizes, and leave as large a corner in the root of the tooth as possible, for strength and ease of cleaning with the oil brush. In small shank cutters it will be found of great benefit to frequently brush out the chips while the mill is cutting. Brushes with tin handles, called oil brushes, are made for this purpose.

Fig. 1 shows a shank cutter of $1''$ diameter that is properly constructed. The temper should not be left as high as in larger cutters, but should be drawn so that a good sharp file will take hold of them easily. If the grinding machine is of the right kind, shank cutters can be ground very easily and perfect, both on face and periphery. The shank cutter need not, of course, be made straight, but of any shaped profile, and if made like Fig. 2 will be very handy for finishing around the inside between the arms of hand or balance wheels, or rounding the edges of crank handles or wrenches. In the form of Fig. 3 it is useful for cornering work for a finish. All this class of work can be done in less than one-quarter of the time that it takes to do it by hand, and with no comparison as to quality. In all of the operations mentioned no fixtures are necessary, except the ones sent with the machine. A small boring tool, made to fit into the collets, is very handy. I have seen a crank handle held in the universal chuck of the milling machine by the hub, the hole drilled, bored out, reamed, and the face milled off with a face-cutter, the edge of the crank all around finished with a cutter shaped like Fig. 2—all this before removing it from the machine. It was only necessary to drive on a mandrel, turn the hub and square out far enough to let a shank cutter do the rest of the milling, and it was ready for hand finishing. This kind of work can be done in one-half the time it can be done in a lathe and planer. The cut, Fig. 4, will show the position which it was held in during the operation. The drawing is a plan view of the machine.

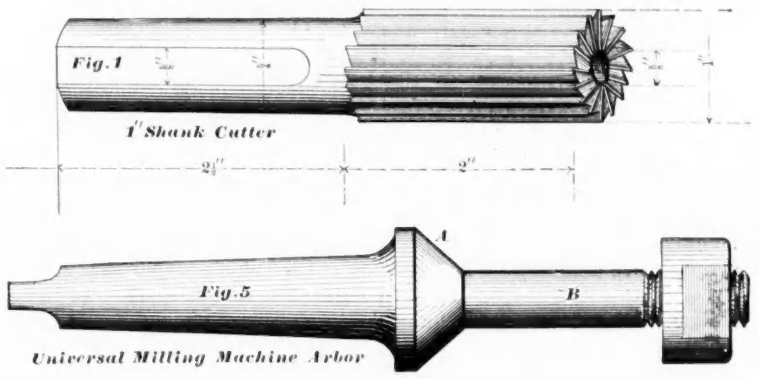
The shank cutter is also valuable in squaring the sides of nuts and screw heads for the wrench. In screw heads it must be used against the end of the cutter, and may be held in the chuck when in a horizontal position and milled by using the elevating slide, or, the chuck may be elevated to perpendicular, and the cross feed used. When used for milling nuts or any such work, it may be used in either way, cutting on the end or periphery, as best suits the work. Cutters are made in the form of shank cutters for milling the dovetailed splines where it is necessary to secure a key into a shaft. A cutter nearly the size of the smallest finished part should be used first, and if the slot or spline be small it will be necessary to take several cuts with the first cutter.

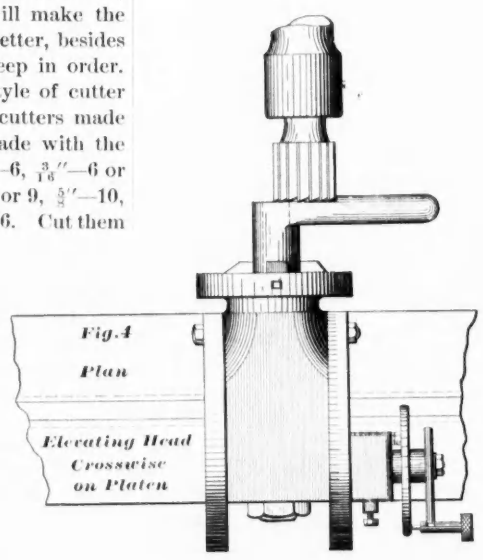
Finishing cutters of this kind are seldom used, one cutter being sufficient, but where a number of pieces are to be milled it will be better to use a roughing and finishing cutter. If the corner of the teeth on the end are stoned off and slightly rounding, a much finer finished surface can be produced.

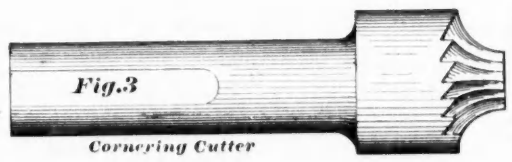
An adjustable drill chuck, fitted to the spindle, being interchangeable with the elevating head spindle makes a very convenient thing to have, as when cutting small splines in spindles or shafts, the hole for the introduction of the shank cutter, or small index plates and jigs and fixtures, can be drilled. I have found that a chuck of any size up to $12''$ diameter fitted to the spindle is very convenient for doing many odd jobs; milling cutters can be chucked out and faced off. Worm chasers should be fitted to the same collets that hold the shank mills, that is the small sizes, say up to $1''$ diameter. Larger sizes may be made in the same shape as milling cutters fitted to an arbor.

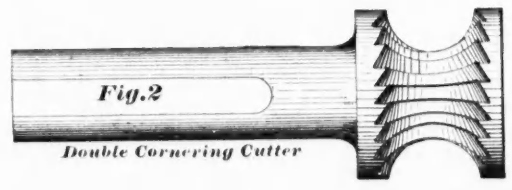
The universal milling machine is the best place to chase, or hub out, a worm wheel. After being cut with the worm-wheel cutter the base or swivel slide is swung around at right angles to the spindle, and finished with the worm chaser. The worm chaser is only a form of milling cutter, and if properly made will cut as free and smooth as any other cutter, and by using the adjusting stop, when a number of pieces are to be hobbed out, each one can be made an exact duplicate of the other.

Various forms of arbors have been tried for the milling machine. I have received a sketch of one, shown in Fig. 5. As will be seen the idea is to make this arbor universal as to holding cutters with different sizes of holes. I have never seen this kind of arbor tried for holding cutters, and although the parties using them say that they work very satisfactory, I would not advise their adoption or use, and for the following reasons: In the first place all the strength that can be got in a milling machine arbor is none too great, and in using this arbor with cutters having large holes, the very thing that the large hole is designed for is lost; that is a solid, or more properly speaking a rigid, arbor. In the next place the contact surface is extremely small at *A*, and unless the arbor is hardened, and, ground as the makers say it should be, it will very soon wear out of truth. Finally, if the end of the cutter and the face of the binding nut are not perfectly true, the cutter not having any bearing at *B*, must be thrown out of truth considerably.









I think that for good solid and accurate work the arbor described in my first article will be found to be the best and safest to use.

I have received inquiries from parties asking if, in tempering the cutters as described in a former article, the cutters were left as hard as they were when taken out of the bath. It has been my practice never to temper any tool of a costly nature without testing with a file. No matter how uniform the steel may be, it only requires a slight difference in the manner of working in the smith shop to change the nature of it enough to destroy the chance of all pieces being hardened perfectly uniform. Therefore it is better to apply the file test in every case.

Hard Times for Railroad Men in Mexico.

A locomotive engineer in Mexico writes to the *Locomotive Engineers' Journal* as follows: "Track-laying has been rushing on the Central for the past two months, until last Saturday, October 13, when it was temporarily stopped by reason of the worst wreck that has ever happened on the road. The particulars, as near as can be learned, are as follows: A train of about forty cars of material and two heavy engines was *en route* for Aguas Calientas, and when near the latter place the first engine was cut off for the purpose of crossing over a temporary bridge, as it was not deemed advisable to cross it together, and when the light engine was on the bridge it gave way. While going down, the engineer, Tom DeLury, called for brakes, to warn the train engine; but, alas! too late. The train pushed the engine into the broken bridge, and it went down along with eighteen cars of material. The result was that engineer DeLury, a worthy young man, and Edward Hopkins, another engineer, who was riding on the first engine, were both killed. Mr. Hall, engineer of the second engine, reversed, and jumped off and escaped, but he has not been seen since; neither has the conductor, Rigg, and it is supposed they have skipped the country to avoid arrest, as that is the way they treat men who have accidents here. Where the responsibility rests is not yet decided; but there is assuredly a responsibility somewhere, notwithstanding the first report was that the men were disobeying orders and were running across the bridge with their engines coupled together; but, after investigation, it was clearly proven that they were not disobeying any orders, but were carrying out their orders to the letter, and were not to blame.

"In regard to being arrested and confined in jail, I will give the boys another point. One of the passenger engines struck and killed a person who was trying to cross the track ahead of the train, and the engineer was arrested and is still under arrest, and when he will get out, 'quien sabe?' as the Mexicans would say. Another engineer killed a man and was arrested, but was released, and he supposed it was all settled; but he was summoned before the judge to-day for the purpose of making a statement of the case, when he was arrested, and sent under guard to jail. Now the question naturally arises, when will the company make some arrangement to protect their men? Will it be when a few more are in jail, or will it be when the men will be obliged to choose between laying in jail six months or a year when an accident, which it is an utter impossibility for them to avoid, occurs, or leave the country? Ponder well before you come to Mexico. This is no fiction, but stern truth, and very mildly drawn at that."

Denver's Needs.

From the Denver *Journal of Commerce*.

"It needs hundreds of manufactories in which shall be made everything that is required in the new west, from a pane of glass to a steam engine. It needs more bone and sinew, and less men who live by their wits, less lawyers and speculators. It needs fewer calliopes and church bells, and more Christians with less confusion. It needs a thousand cheap tenement houses in which mechanics and the commonalty can live, and not starve. It needs more mechanics and fewer real estate agents and gamblers and thieves. It needs two at least free bathing houses where the rabble can be made clean. It needs more cheap meat and less high-priced grog. It needs an elevated tramway to the Highlands, connecting East with North Denver. It needs an army with shot guns to collect the present sewer tax. It needs more industrious men who are willing to live without office, and less Micawbers who constantly are 'waiting for something to turn up.' And lastly, and above all other needs, it needs better daily papers and fewer of them."

Co-operation Among Rolling-mill Men.

The members of the Passaic Rolling-mill Literary Association, Paterson, N. J., recently made a successful experiment in co-operation. About one hundred and thirty members joined together and purchased a carload of flour. When all expenses were figured up, it was found that a saving of two dollars per barrel was effected, and the flour proved equal if not superior to what had cost the men the high price. They are so much gratified with this experiment that they are now contemplating further efforts in the same line. Butter is receiving their attention, and other household commodities will follow in the near future. Too many middlemen, each of which must have a profit, make, they think, the price of the necessities of life too high.

We recently received a call from H. O. Reinhardt, M.E., of Chihuahua, Mexico, who has superintended the erection of silver mining buildings and machinery in that country. He reports the silver mines of that part of Mexico as exceedingly rich, and they are being worked with great profit. The prospects are that a largely increased demand for American mining machinery for Mexico will be experienced next year. There are no machinery dealers or machinists' supply stores in Mexico, and everything required must be brought from abroad. No foundries or machine shops of any consequence exist in that country. The duty on mining machinery is a quarter of a cent per pound, regardless of its value. The two railroads (Mexican National and Mexican Central) are doing much to develop the industries of the country. Mr. Reinhardt erected the first electric lighting plant at Chihuahua about three months ago. He will put in others upon his return. Revolutions and Indian depredations have greatly retarded the progress of Mexican industries, but these troubles are fast disappearing as quick transportation by railroad is becoming an established fact.

Pennsylvania Railroad Shops in the Jersey Meadows.

On the meadows between Jersey City and Newark, are located the extensive repair shops belonging to the eastern divisions of the Pennsylvania Railroad Company. Were it not that the importance of these shops is overshadowed by the magnitude and world-wide reputation of the Altoona shops, they would attract great attention for their extent, their perfect arrangement, and the excellent system followed of doing work. During a hurried walk through the various shops, we were forcibly struck with the orderly manner in which the great mass of material is arranged, and with the systematic methods of executing the repairs. In the machine shop they follow the plan of grouping machines of various kinds together. Thus, one section is devoted exclusively to planers; all the axle lathes, and those doing wheel-work, are grouped together. Small lathes, devoted to general work, have a place for themselves, and they are not mixed up with slotters and milling-machines and drill-presses, which are all found in departments that are understood to belong to them. The erecting shop is divided into two parts. One part has the pits, where the engines undergoing repairs stand; the other is a room devoted entirely to fitting. As an engine gets stripped, every part is sent to this fitting room, and a force of machinists do the work that does not require the use of machines. Any work that requires turning, planing, drilling, etc., is sent to the machine shop, but comes to this fitting room to be put together before being returned to the engine. The only power-worked tools in the fitting room are emery wheels and grindstones. At present there are seven engines in the erecting shop. Each engine has a gang of workmen directed by a gang boss, the whole being under the supervision of a shop foreman. The round-house holds forty engines, and was pretty well filled up. Considerable light repair work was going on in this department. A valve sea-facing machine was at work on one engine, and a great many rods were down for refitting. In this house we observed that every stall has permanent rollers in the track under the driving-wheels, so that when any work has to be done which requires the revolving of the wheels, everything is ready so soon as the side-rods are taken down. The erecting-shop tracks are also provided with rollers of this kind. The smoke-jacks in the round-house are all of the telescopic order, and can be lowered upon the top of the engine-stack when desirable. The house is warmed by steam-pipes ranged round the inside walls. There appears to be sufficient area of pipes to warm the house on the coldest day, but we do not consider the wall to be the proper location for pipes to heat a round-house. When an engine comes in from a trip on an intensely cold day, all the box-packing is frozen solid. It is important that all this packing should be thawed before the engine goes out again, and the best way to do so is to have the heating-pipes in the pit below where the engine stands. In this house the old locomotive, the "John Bull," is laid up for preservation. Outside, in the yard, stands quite a row of superannuated engines, that are interesting relics of by-gone locomotive design. There is an ancient Danforth & Cooke, with hook motion and riding cut-off; and an early form of Rogers', with the link motion outside of the frames, small cranks acting in place of eccentrics.

Cutters for Involute Gear Teeth.

BY FRED. J. MILLER.

For those desirous of using the involute tooth for gear wheels, I would recommend that they make and use a device lately designed by J. F. Webster, superintendent of the Champion Bar & Knife Co., Springfield, O., which it is believed secures greater accuracy in the form of involute gear cutters than has been ordinarily attainable heretofore. It consists of a holder, *a*, shown in Fig. 3, which is made to receive and hold the tempered steel discs, *b*, the upper edges of which are used for giving shape to the cutters. The holder may be used in the lathe the same as an ordinary tool, or it may be held in the vise of a milling machine, while the cutter to be shaped is on the arbor where it is to be used.

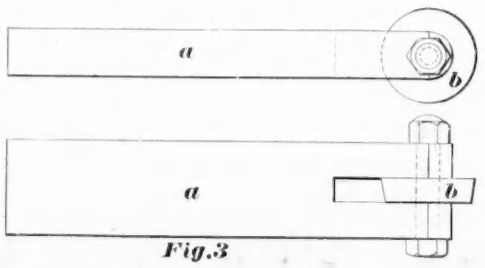


Fig. 3

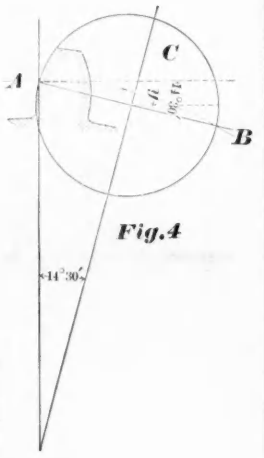


Fig. 4

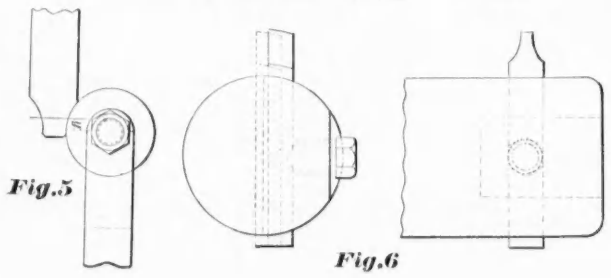


Fig. 5

Fig. 6

For convenience, a fine line is drawn across the top and down the sides of the holder, which is made to exactly coincide with the center of the disc, as shown. The discs are made the exact diameter of the rolling circle of the gear to be cut, viz.: one-fourth of the pitch diameter. Now referring to Fig. 4, *A B* is an arc of the pitch line of a gear wheel, *C* is the rolling circle, the center of which is at a distance *y* from the tangent of the pitch line. The distance *y* is the natural sine of the angle 14° 30′ when the radius equals the radius of the rolling circle. Consequently with a radius equal to the pitch diameter of the wheel

$$y = \frac{\text{sine of } a}{8} = \frac{.25038}{8} = .0313 \text{ nearly.}$$

So, in using the device, all that is necessary is to bring the line on the holder to a distance from the tangent of the pitch circle equal to the pitch diameter of the wheel multiplied by .0313, as shown in Fig. 5. Then by feeding the disc laterally against the cutter it can be reduced to the proper thickness and to an absolutely correct shape.

The discs work much better if they are finished to size by grinding on an arbor after being hardened. They can be revolved in the holder, and used until the entire circumference becomes dull, when they may be sharpened a few times by grinding on the upper face, without much alteration in size.

When it is desired to do very accurate work, it is probably better to use a fly cutter, shown in Fig. 6.

It cannot "wabble" on account of any springing out of truth in hardening, and thus cut the teeth too thin, and of a shape different from that of the cutter itself, as the ordinary cutter is liable to do.

The cutter should be shaped by the disc while in the position shown; then when it is to be used the liner should be taken out of the arbor and the cutter advanced to the position shown by the dotted lines. It will then be found to have proper clearance, and can be ground on the face without altering its form.

As a further refinement, care should be taken to have the cutter, when in use, as much in advance of the center line as it was in the rear of it when shaped by the disc, else it will not cut the exact form of tooth due to the position of the disc when the cutter was shaped. Not nearly as much work can be done in a given time with a fly cutter as with one of the ordinary kind, however, Chordal to the contrary notwithstanding. It is only recommended in cases where the amount of gear cutting to be done will not justify the expense of a regular cutter, or where the greatest attainable accuracy is desired.

Death of a Malleable Iron Maker.

In Buffalo, on the 30th of Nov., James Favor, for many years a foreman in the Malleable Iron Works of Pratt & Letchworth, died in his seventy-seventh year.

Mr. Favor was born at Clairegoutte, in the east of France, May 12th, 1807. He came to New York while still a young man, a pioneer in the then little-known process of making malleable iron castings, and was for a number of years engaged in its manufacture with Manville & Co., at Elizabethport, New Jersey, where it was early brought to a high state of perfection. About the year 1864, Mr. Favor became connected with the Malleable Iron Works of Pratt & Letchworth, of Buffalo, in a responsible position, and during a period of twenty years, and until within two days of his death, gave to the manufacture of malleable iron castings that constant and watchful care so imperative to insure peculiar excellence.

If to have lived to have done some one thing well is a merit among our workers in these arts, Mr. Favor has well earned that merit.

The locating of the New York, West Shore & Buffalo Railway repair shops at Frankfort nine miles from Utica, is reported to have caused great disappointment and annoyance to the property owners in the latter town. In procuring the right of way through Utica this railroad company experienced much trouble with some of the largest land owners in settling for damages, and it is said that this led to the abandonment of an intention to establish the repair shops at Utica. This decision was well understood to be a serious loss to the city. Recently an order has been given to remove the division offices of the road from Utica to Syracuse, which will take away about seventy-five men.

Catechu for Steam Boilers.

German technical papers have been giving considerable prominence lately to statements concerning the use of catechu in steam boilers for the prevention of scale. Catechu is a dry, brown, astringent extract obtained by decoction and evaporation from the *acacia catechu*, a tropical tree grown extensively in India. Experiments with this substance in boilers that were badly coated with scale showed that it cleaned off the incrustation and precipitated the lime salts in the form of mud which could be blown out. When the substance was used with water badly impregnated with lime, it prevented the formation of scale, and there was no trouble experienced with foaming as so often results from the presence of anti-incrustators. The use of pure water is the best means of preventing scaling of steam boilers, but in some localities it is impracticable to obtain tolerably pure water, and in such cases a scale preventor which will not injure the iron or cause foaming has considerable value.

Improvements now being made in the Bessemer process are expected to cheapen the cost of making rails $5 a ton, if not more.

From the Glasgow *Engineer* we learn that the ship building in the Clyde is becoming intensely depressed. In the upper reaches of the Clyde, it appears that within the last few months 4,186 workmen have been discharged, and greater reductions of men are expected within the next month. Acute suffering already prevails among the families of the men thrown out of employment.

Secretary Chandler on the Navy Yards.

In his annual report the Secretary of the Navy speaks a good many plain truths in a direct manner about the present condition of the Government navy yards.

"Much difficulty," the report says, "has been experienced in effecting navy yard reforms, owing to the opposition of persons interested in the existing system, not only to closing the repair shops in yards to be hereafter kept only as naval stations and arsenals, but also to concentration and economy at yards which are to be kept open for work. The assistance and specific directions of Congress should therefore be sought and effectively accorded. The arguments and facts which show that reforms should be instituted are overwhelming. The change of naval construction from wooden to steel ships would of itself involve a revolution in methods of work. With but little more than thirty vessels in commission, only five or six have required repairs at any one time, and by distributing these among as many navy yards, the cumbrous organization and heavy expenditures at each yard have been hung upon and charged to the one ship then in hand, with the results which published records have shown.

"The question whether all the steel naval vessels of the future shall be constructed by contract, or some of them by contract and some in the navy yards, it is not necessary immediately to determine. Assuming that the hulls of such ships might be judiciously and economically built in the yards, it is doubtful whether the machinery will ever be so constructed. All the engines for the British Navy are built in private shops. But conceding that, wherever the ships may be originally built, it is desirable for the Government to possess shops fitted for such repairs as may from time to time be found necessary, it is due to truth to declare that the Government repair shops under the present system ought not to be intrusted with them. These establishments must first be thoroughly re-organized in such a way as to exclude all political considerations from their management, otherwise bad and expensive work will be the result. We cannot afford to destroy the speed of our naval engines in order to make votes for a political party.

Whatever other Governmental agency may be conducted with partisanship, a great naval workshop, dealing with the hull of a modern steel steamship, its fittings and equipment, and with the complexities of its machinery, cannot be successfully so managed. No charge of favoring private shipbuilding establishments should deter any one from asserting that, until the navy yard workshops are managed on business principles and without regard to politics, the construction and repair of the new American Navy should be committed to those builders who employ or discharge their foremen and all their artisans according to their skill as mechanics, and without caring for their political opinions or votes."

Coxon's Stop for Engine Lathes.

The engravings with this represent the construction and application of this device, the object of which is to throw off the feed of the lathe, stopping the cutting of the tool at such a point in its progress as it may be adjusted for. Fig. 1 shows the arrangement of the device on a lathe, and Fig. 2 the knob for operating the friction of the lathe feed. It consists of a bracket *A*, made to be readily attached to the front way of the lathe in any desired position, so that the finger *a* will reach to the lug *b* on the hand-knob *B*. When properly adjusted, as the carriage moves forward this lug comes in contact with the finger or bunter, which partially revolves the knob *B*, disengaging the clutch.

The rod *a* is connected to bracket *A* by a double eye. The lower eye is threaded to receive the threaded end of *a*, so that by means of thumb and check nuts *D* the length may be correctly adjusted to make the stop operative at the exact point desired. Thus, in practice, the bracket *A* is located approximately, and the exact adjustment made by shortening or lengthening the finger *a*. The upper eye is at right-angles to the lower one, and is fastened to the bracket by a set-screw. It can be moved in or out or up or down to suit different make of lathe.

The bracket (*A*) is made in two pieces. The upper piece has a bearing on the way and top of bed, and the lower piece on the rack, the two parts being connected by screw and ways or guides, which provide for varying distances between the two parts, and at the same time for rigidly clamping.

The hand-knob *B*, Fig. 2, is made so the outer portion carrying the stud or lug can be adjusted by rotating it about the inner portion, so as to bring it to the proper position for contact with the finger at the right time, the general construction for this purpose being clearly seen by the engraving.

The lever *I*, Fig. 1, is for reverse motion to the knob, moving it to the left. The use of such a device as this in turning a number of pieces an exact distance without measuring or marking, or for other purposes, will be readily seen. It is the invention of W. H. Coxon, 199 Chandler St., Worcester, Mass.

In a series of carefully managed experiments to ascertain the exact friction of lubricated bearings made by a London engineer, it was found that a change of direction in the revolution of the axle greatly increases the friction for a short time after the change. This is a fact which has been long observed by engineers running locomotives. The bearings of an engine will often run cool for months without the least indication of heating, so long as the engine is continually run head first. But let any circumstance arise where it is necessary to run a few miles backing up, and there is sure to be some hot boxes. From the experiments referred to, we would infer that when a locomotive or machine has to change the direction of its motion, the party in charge can prevent heating by increasing the lubrication till the tendency to heat ceases. It is supposed that the increase of friction following change of direction is caused by the surface fibres of the metal which have been smoothed down in one direction, rising up and locking with each other when a reversal takes place.

The *Marine Journal* mentions a case where a steamboat engineer went to sleep while on watch, and when he awoke no sign of water could be seen in the boiler. He did not dump the fire and take proper precautions to prevent an accident from overheated sheets. No, but he started up the pump and ran to the fantail of the boat as a place of safety. Presently the boat boiler blew up and killed ten persons. Instead of being strung up, or being sent to grace the inside of a penitentiary for the rest of his natural life, that engineer is following his chosen business of river engineering.

Extension of the Philadelphia and Reading Shops.

In reply to a letter asking for particulars about the current reports that the Philadelphia and Reading Railroad Company were making arrangements to build their own locomotives, we have the following:

"Replying to your favor of the 30th ultimo: The several paragraphs which you have seen going the rounds of the daily papers with regard to the company building its own locomotives for the future are not substantially correct.

"We are now engaged in enlarging our shops at Reading in order to meet the increased wants of the company, but a large portion of these improvements will be required for facilitating repairs to engines as our shops have been very much behind hand in this respect, especially the blacksmith and boiler shops, which you doubtless observed if you passed through them when making your recent trip over our line.

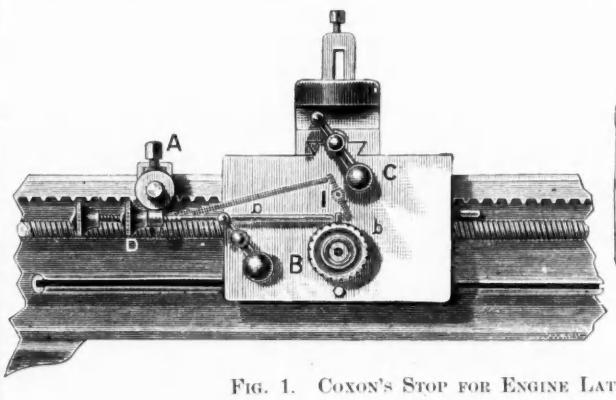


FIG. 1. COXON'S STOP FOR ENGINE LATHES.

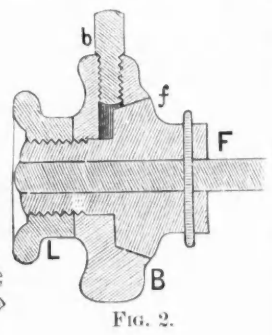


FIG. 2.

"It is expected that our shop facilities will be so far increased as to enable us to build more locomotives annually than has been our practice for several years past. Beyond what I have specified, however, no extension is at present contemplated."

J. E. WOOTTEN,
General Manager.

Notes on Repairing Boilers.

BY W. H. H.

* * * * * * *

The leaky rivet which, on several occasions, you thought to stop by caulking and hammering, you have got sick of fooling with, and cut it out, tapped the hole, and screwed in a short bolt. Upon this leaky rivet hangs a tale, which we will now unfold. When you bought your boiler you noticed, while it was yet lying in the yard of the boiler maker, some water had—unaccountably, for they do not test their boilers hydrostatically in your part of the country, as the boiler makers say it *strains* them—found its way inside, and some was leaking around this very rivet, and you called the attention of the boss to this fact in a timid, deferential manner, you, being distrustful of your own senses, not having had much experience with boilers, particularly new boilers. The good, honest man looked you fair in the eye, and in a tone of voice implying surprise at the suggestion of such a thing as a leak in one of *his* boilers, and pity for your greenness, and with the bland manner which the vendor, whether it be of peanuts or of "securities," assumes toward the prospective vendee, explained "that it was only weeping a little," and "all new boilers weep," and that it "would take up as soon as steam was on," and in proof of his statement showed you another boiler, in a very melancholy condition—probably because it was about to be sold away from its home and kindred.

While this was going on, you noticed through the dirt a strange contortion on the face of a wiry little chap, who was hanging on the end of a thing with a long handle, projecting from a hole in the end of a boiler, and you felt sorry for the poor little boy, who had most likely at a tender age been blown up by a boiler, or a powder mill. But as you were getting into your buggy, you overheard the boss going for the young contortionist something after this style: What in blazes were you making such an infernal grin about, when that countryman was looking about the yard? And the reply comes in an aggrieved tone: "Why, I warn't a grinnin'; only the other day, me and big Scotty wuz a helpin' on that biler, and Scotty, he sez, come here, little one, he sez, and hold up a bit, till I go and git a drop of beer; an' I wuz a holdin' up as hard as ever I could, and the two riveters a battin' away as hard as ever they could, and that little divil, Patsy Gallagher, kem up behind and touched me with a hot rivet, an' I let go my hold, and went and basted his bloody heyes." You drove off wondering if this little episode had anything to do with the leaky rivet in your boiler. Most truly it had, my friend; and the moral of this tale is, that the "holding up inside" should be most carefully attended to.

* * * * * * *

Some of the tubes in your boiler persist in leaking, in spite of all you can do. These are some which are very close to the shell; the different rates of expansion in the shell and tubes cause the slight joint at the tube ends to start. It is a very common defect in horizontal boilers, and comes from the passion which men have to get as much boiler as possible for the money which they expend. The boiler maker who has the skill to handle a pair of compasses will, if you require him, crowd in tubes enough to make a 50-horse power boiler in a 4-foot shell. In doing such work, the holes in the tube sheet are many of them located even in the fillet of the flange, where it is impossible ever to set them properly. You cut these tubes out entirely, and stop the holes by putting a piece of plate iron inside, with a piece of gum to make a joint; and, winding some wick under the head of a bolt, pass it through a hole in the center of the plate, and through a similar plate outside. You then screw up the nut, and draw the two plates up to the tube sheet. It is best not to pack the outside plate, as it makes the thing too elastic, and one joint properly made is as good as more.

You were so unlucky as to have the water down in your boiler. This started the whole upper row of tubes, and you must tighten them. If, in the beginning, you had bought the Dudgeon expander, you would now be able to save its cost; but economical considerations prevailed with you, and you got the two tapered plugs. You insert one of these into each end of the tube you propose operating upon, and drive them with light sledges at the same time, two strikers keeping stroke together. The plugs are kept well greased, and frequently removed and turned around. The beading is set up, with a beading or boot tool, and lastly the plugs are again inserted and a few light blows given.

It may happen that you wish to set some new tubes, which do not fill their holes. In such a case it is best to heat the tubes in the forge fire, and, with a light hammer, draw them on the horn of the anvil until they are of the full diameter required. This drawing should extend in sufficiently far that there shall be no danger from splitting when the plug is driven. In setting new tubes, care should be taken to cut each tube to the required length, each one for its own place, leaving one-quarter inch projecting for the bead at each end. The tubes are readily cut with a cold chisel, and finished neatly with a file. If you have an expanding tool, the above directions do not apply, as the tubes may be, and better be, left with an inch or two projecting into the smoke box. Such tubes are then long enough to bear resetting when the fire end has become wasted away. When an expander is used, no beading is necessary; in fact, the setting is better without, and in any case the expander should be put in and used, after the beading, to restore the set which may have been destroyed.

To weld two sections of boiler tubing together, scarf one end with a file, or in the lathe, and bell the other, inserting one in the other in the fire, keeping them in continual rotation. When the welding heat is attained, tap the point of junction lightly and very fast with a hammer weighing about two ounces, provided with a handle made of $\frac{1}{4}$" round iron, so as to be non-combustible, as you do not remove the tubes from the fire when you are hammering. It is not necessary to use a flux, as tubes are made of iron which welds easily without it. Copper ends, in former times, used to be brazed to iron tubes, using hard solder or yellow brass. This was before the days of expanders, and was done to facilitate the setting. The experience of locomotive superintendents had, at that time, been mainly with copper tubes.

It has been stated that tube iron is easy to weld, and it is this property which, for reasons partly chemical and partly mechanical, causes the tubes to be more quickly corroded in some parts than others. This corrosion manifests itself sometimes by a round hole, and sometimes by an irregular opening of any shape or size. If the leak is not too bad, you can run on until night, and then, after the fires are out, drive a pine plug into each end of the tube. This will enable you to keep on until the end of the week, and give time to prepare a more permanent stopper. If you have the time, you can remove the tube entirely, and if it is located near the shell the holes may be stopped with the plates, and short bolts, as before described; but if it is toward the center, the tube sheet requires staying to sustain the pressure, so as to prevent the starting of leaks in the setting of the adjacent tubes. You accomplish this by passing a $\frac{3}{4}$" rod, with a thread at each end, through the length of the boiler, then putting on a plate with the edges slightly lipped, so as to retain the packing material, and tighten up the nuts. For a packing material sheet gum may be used, but the best to resist fire is made of red and white lead putty, into which a considerable quantity of iron borings have been worked. This cement is the standard stuff for all soft patches about a boiler. If rightly made it becomes very hard in time. White lead by itself is of no use for a boiler cement, as, when heated, it runs like molasses, and the steam or water soon follows.

* * * * * * *

A soft patch is a temporary expedient for stopping a leak, but in many boilers which have become wasted away through long service, it is about the only thing which can be used, as there is no good metal to rivet to anywhere near the leak, and it would be impossible to make a job of riveting that would bear the strain of caulking.

The patch, if on the outside of a boiler or removed from the fire, may be applied as a plaster directly upon the iron without cutting away the defective part; but if over or near the fire, the defective part should be cut away, so that the water may have access to the sheet of the patch.

If the defective spot be in a part of the boiler of complicated shape, it is often con-

venient to make a template of sheet lead, which can be easily bent to the required form, and taken to the forge as a guide in shaping the iron. This iron should be about one-quarter inch thick, and good flanging stock. The corners should be rounded off on curves of large radius, and holes drilled for the free passage of $\frac{5}{8}$" bolts about $1\frac{1}{2}$" from the edge, and spaced about $2\frac{1}{2}$" apart. The edges of the sheet should be carefully lipped down, after the plate has been finally fitted to place. This lip may project about $\frac{1}{8}$", and should be very uniform in depth; this is to retain the cement, which might otherwise be blown out. The holes are marked to their placed and drilled, and all burs removed inside the boiler. The bolt heads are provided with stout washers; a little hemp or cotton wick, well saturated with red lead putty, is put between the head and the washer, and the washer and bolt wound with some of the same. To get these bolts into place, with their heads inside the boiler, is sometimes troublesome, and in such cases they are "strung in;" that is, a long string is passed through the bolt hole into the boiler, and poked out through the most convenient opening, and made fast to a bolt, and when the attendant sings out, "All right," you haul the bolt into its place.

The cement is laid on the patch in a belt about three inches wide, extending all round the edge, and about half an inch thick. Two bolts may be put in place before the patch is applied, and the others inserted by stringing, or otherwise.

LETTERS FROM PRACTICAL MEN.

Compound Engines on Western Rivers.

Editor American Machinist:

Since writing concerning compound engines on Pittsburgh tow-boats, I have received some indicator cards from Mr. Harris Tabor, which I inclose. He informs me that they were given him over a year ago by Mr. Levi Shook, a prominent Pittsburgh business man and former river engineer, who took them from the engines of the J. B. Williams, one of the boats mentioned in my former communication.

These boats are stern-wheelers, and, like all Western river boats, "tow" everything in front of them. The coal "boats," of which a coal tow is composed, are simply rectangular boxes of $1\frac{1}{2}$" plank, averaging, perhaps, 30 feet wide by 150 feet long, and 8 feet deep. These are firmly bound together and to the steamboat by "twisters," "ratchets" and "bridles," forming a solid mass, covering a surface of $2\frac{1}{2}$ or 3 acres, and containing about twenty-five thousand tons of coal.

I believe that the J. B. Williams has taken thirty thousand tons in one tow. The trip from Louisville to New Orleans averages, perhaps, two weeks, the steamboat consuming about fifty tons of coal every twenty-four hours.

Only a limited number of pilots can be found with the necessary skill and nerve to handle these big tows among the tortuous channels, shifting sands, and treacherous snags of the Mississippi. Each tow-boat has two pilots, who receive $600 each for the round trip from Louisville to New Orleans and return, and five to seven trips are counted upon for a season's work.

The crew numbers from fifteen to twenty men, and the running expenses are estimated at $200 per day.

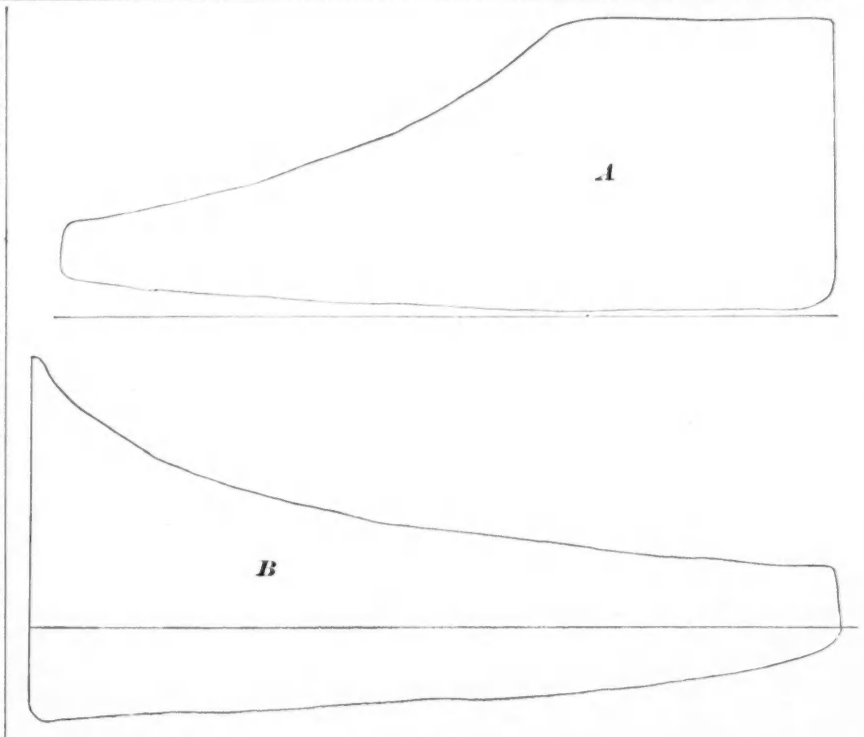
Smaller tows are taken from Pittsburgh to Louisville, on account of the numerous bridges over the upper Ohio and the rapids at Louisville, known as the Falls of the Ohio.

C. SEYMOUR DUTTON.

[The data on the backs of the cards are as follows:

CARD "A."

Diameter of cylinder	$19\frac{1}{2}$"
Length of stroke	9 ft.
Revolutions per minute	$14\frac{1}{4}$
Boiler pressure	165 lbs.
Vacuum per gauge	28"
Temperature of hot well	90°
Temperature of feed	200°

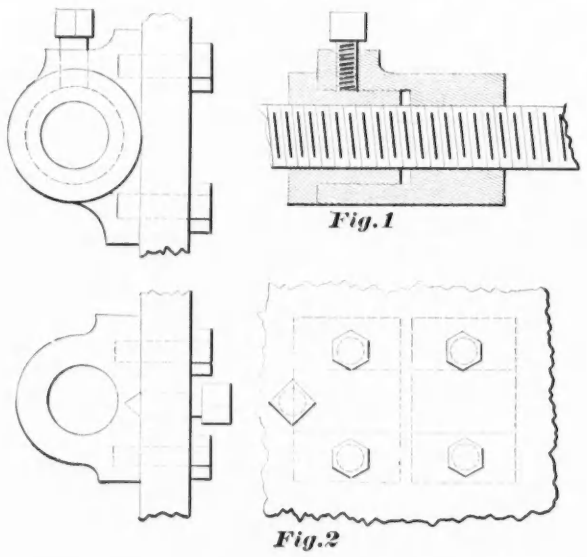


Scale of spring.....1"=100 lbs.

CARD "B."

Diameter of cylinder	$44\frac{1}{2}$"
Length of stroke	9 ft.
Revolutions per minute	$13\frac{3}{4}$
Boiler pressure	162 lbs.
Vacuum per gauge	27"
Temperature of hot well	90°
Temperature of feed	200°

Scale of spring.....1"=24 lbs.]



Adjustable Nuts for Machine Tools.

Editor American Machinist:

Why is it that tool builders do not make provision for taking up the end play of nuts on the screws of planer and shaper heads, as well as lathe cross-feed screws? This lost motion becomes very annoying when they become worn, and as nothing reliable can be done by a loose screw, work is often spoiled. An inexpensive arrangement can be made to accomplish the end of obtaining a perfect fit endwise, until the nut is entirely worn out.

The accompanying sketch shows some devices which are simple, and would meet the requirements. Fig. 1 shows a plan in which one-half of the nut is bored out to receive another half which is turned off to fit, and is held fast by a set screw. When adjustment is required, the set screw is slacked, and half of the nut is turned in the other half until a perfect end fit is obtained; then the set screw is again fastened.

Fig. 2 shows two separate nuts, fastened to the head by screws. To adjust, the one is loosened, and by a tapered end set screw is forced towards the other, until adjusted, when it is secured again by the fastening screws. The idea is likely not new to many, but as it is of great value to a machine, the wonder is why it is not used. In the shop where the writer is employed there is one machine in which an attempt was made in that direction, and the arrangement would be very good if it had been properly constructed. It is made with an ordinary nut, and a small plate fixed on one end with two small screws, but this plate contains but one thread, where the nut contains about eight, so that this one thread is supposed to do as much work for motion in one direction as the eight threads have to do in the other; consequently the thin plate soon wears out and is ready for repairs. The proper plan would be to have both equal, so that the wear would be alike. I should like to hear from some of the tool builders as to why something is not done in this direction, or what the disadvantages would be. This plan of nut adjustment, together with a good end adjustment of screw at its bearings, would certainly be an important matter in machine tool construction.

A.

Possible Mistake in Measurement.

Editor American Machinist:

I have just noticed an article in the current number of the AMERICAN MACHINIST on the possibility of draughting water 37 feet vertical lift with an ordinary pump.

I remember, while quite young in years as well as in experience, of reading a discussion among a body of learned men (so called) as to how it was possible to put a fish weighing a pound in a globe filled to the brim with water, without spilling any of the water. After the discussion had become "quite warm," one of the old fathers procured a fish and proved by ocular demonstration that it could not be done. Knowing our friend Stewart's high regard for truth, I do not wish it to be inferred that I think he has been giving us a fish story; but I do wish to ask him if he has measured that lift with his two-foot rule?

Yonkers, N. Y. W. H. ODELL.

A Question Answered.

Editor American Machinist:

In your issue of December 15th you give cut of turbine water wheel, and dimensions of parts. Could you give dimensions of man in scene by same scale? W.

Certainly. The man in the scene is five feet eight and a quarter inches high, and was made to properly correspond with the dimensions of the machinery. Next?

Justice to Boiler Makers.

Editor American Machinist:

The letter from James Humphreys, where he brings Chordal to task for depreciating boiler makers, startles my conscience and I cannot rest without confessing that I also have done injustice to the boiler-making craft. In the course of a long experience in shops, I have been a great deal in company with boiler makers, and unjustly I have often remarked, that I would rather be in the company of ten scolding women whose tongues were tuned to the sharpest pitch. Now, I wish to bear testimony, that the boiler makers are a worthy and harmless class if they do make a great deal of noise in the world, and machinists who wish to appreciate the worth of boiler makers properly can do so if they will only stuff their ears solid with cotton batting. There is often a feeling of jealousy and even distrust in shops between machinists and boiler makers, and I am persuaded that the free use of cotton would do much to dissipate it. Where this remedy is properly applied the machinist would cease to have the consciousness that the other was proclaiming his work's importance too loudly. Even the turmoil made by boiler makers sometimes does good to their fellow men, even as the cackling of geese once ennobled these talkative animals since it saved a great city. There was once a great revival preacher who did great work in his line. His great forte for salvation was in the penetrating power of his lungs. This divine was in his youth a machinist, and he attributed the development of his voice to his habit of talking in the shop where boiler makers were at work.

MACHINIST.

The Distance in which a Locomotive can Attain High Speed.

Editor American Machinist:

A paragraph taken from *Science* is going the rounds of the technical press, which makes the statement that the work of getting up high speed is so severe on an engine that the Zula express on the Great Western Railway of England has been repeatedly timed, and it is found that, though running over an almost absolutely level and straight road, it takes a distance of 26 to 28 miles to attain its full speed of $58\frac{1}{2}$ miles an hour.

This is a striking statement, and makes a readable item, but it is hardly worthy of the journal from whence it came, because it is not true. The train referred to is run from London to Swindon, $77\frac{1}{4}$ miles, in 87 minutes, making a running speed of a little over 53 miles an hour. If it took a run of say 27 miles to reach what is called the maximum speed of the run, 58 miles an hour, the average speed for that 27 miles could not exceed 35 miles an hour. This would take away 46 minutes from the total, 87 minutes, leaving only 41 minutes in which to run the remaining $50\frac{1}{4}$ miles. To make running time under these conditions, the last $50\frac{1}{4}$ miles would have to be traversed at a uniform speed of upwards of 73 miles an hour. It is acknowledged that such a velocity is not maintained. It may be reached occasionally, for a single mile, but the train seldom exceeds a speed of 65 miles an hour.

The engines that run the fast trains on the Pennsylvania Railroad reach their highest speed within three miles of a starting point, where the conditions will permit; and a locomotive that cannot attain a speed of a mile a minute within four miles cannot handle the train properly, and need not be expected to make fast average running time.

Several years ago I had considerable experience with a fast train in Great Britain. A speed of over forty miles had to be made, and owing to loss of speed ascending grades, the level stretches had to be traversed at nearly sixty miles an hour, or the train would get in late. The engines that ran this train had single drivers, seven feet diameter, and

they had no trouble in reaching a mile a minute in three miles, where the road was level. The only difficulty with this form of locomotive is that it loses time getting away from a station when the rails are wet.

LOCOMOTIVE ENGINEER.

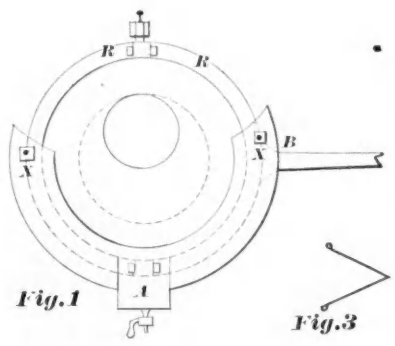


Fig. 1

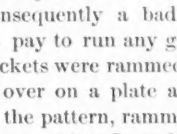


Fig. 3

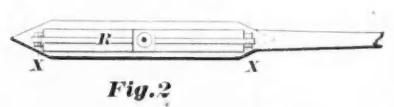


Fig. 2

A Handy Dripper.

Editor American Machinist:

In going from place to place, a practical man is astonished to see the inconvenience people will labor under rather than use their brains, to find some preventive.

I went to take charge of a Corliss engine, with a 4-foot stroke. The main shaft was very short, which brought the eccentric quite near the large pulley, and however careful I was the eccentric would throw oil over the shield and on the inside of the pulley, and from there it would work round into the face and be lapped up by the belt.

After getting acquainted with the place, I adopted, to prevent this, the following device: A tin dripper, heavily wired on the edges and **V**-shaped, as shown in Fig. 3, with a projection on the bottom, and a cock, as at *A*, Fig. 1, for a settling pool, to prevent the oil from throwing up and over when the engine was in motion. This I bolted firmly to the rib of the eccentric, *R*, Figs. 1 and 2, with two small bolts or screws, threaded the whole length and six nuts to each bolt, as at *X X*, Figs. 1 and 2. I cut it out as at *B*, Fig. *1*, on the back side, to let it pass by the rod.

I have now had it in use over a year, and it not only keeps things around it clean, but is a great saving, for it catches every drop of oil, which I draw off once a week. I do not think that any one that tries this will ever regret it.

PACKING.

Effect of the Lack of Knowledge of Foundry Matters.

Editor American Machinist:

In your issue of November 24, "Foundryman" has broached a very important subject, viz.: lack of technical education in foundry practice. What brought the matter more forcibly to mind was, that just at that time I was working on a job that illustrated to a certain extent, if not a lack of technical education, certainly a great amount of stupidity in the designer.

The pattern was new, and apparently the outcome of a new idea in machine tool manufacture. From appearance, I should call it a table or bed. Its dimensions were: 4 feet long by from $26\frac{3}{4}''$ to $19\frac{1}{2}''$ wide. The face was 1″ thick, and the entire surface of one side was to be planed, and consequently should be cast down. The back, as shown in the sketch, was intersected by ribs $4\frac{1}{2}''$ deep, firmly fastened to the face of pattern. The holes, *A* and *B*, passing entirely through the casting, were to be formed with dry sand cores, the prints for which were so placed as to have the casting made face up, the tapering print intended for the cope being placed on the face.

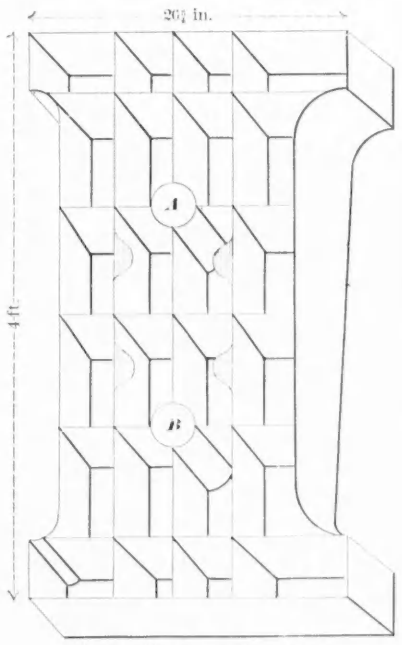
From the fact of the pattern being made in one piece, it was apparent that it was intended to be cast so, and from the same fact it was not only apparent, but certain, that I was going to have a time of it securing the pockets between the ribs, as it had to be done before ramming up, when making it face down, as it should be.

Having no rigging but a plain cope, 5″ deep, I put the pattern in the floor, made a deep joint, and brought it up in the cope. After drawing the pattern, all that could be done was to fill it and firm the corners, as nailing would only disturb the sand from the soldiers that were used in securing the pockets.

Right here comes in the stupidity shown in constructing the pattern all in one piece, instead of in two; that is, the ribs separate from the face, by which means the face could be left down and the ribs brought up in the cope. In that manner I could have nailed the pockets to my heart's content before drawing the ribs. Suffice it to say, that when the mould was poured, portions of the pockets broke away; consequently a bad casting. As it would not pay to run any great risks next time, the pockets were rammed up with core sand, rolled over on a plate and dried. I then bedded in the pattern, rammed up the pockets firmly, over which I made a plain joint, even with the top of the ribs; first setting a drawback at one end and one side, as both had to be drawn back a little to admit of the pattern being taken out, owing to its being draughted for making face up. The parting sand was carefully blown off the pattern, so that a clear and distinct impression of the ribs was left on a perfectly plain cope, by which to set and tie the pocket cores.

By moulding it in this manner a perfect casting was obtained. But what a vast difference there was between this method and that which was intended by the designer.

MOULDER.



BACK VIEW OF PATTERN.

Guide for Venting Cores.

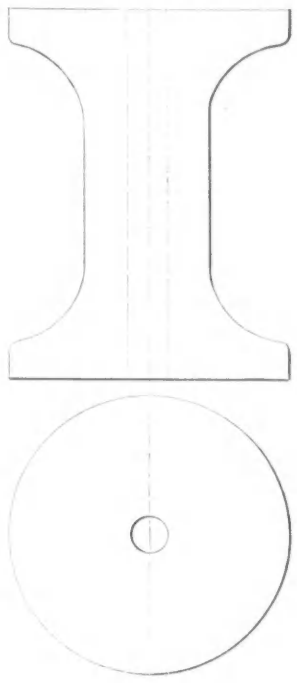
Editor American Machinist:

No one but a moulder will ever know the peculiar vexation of taking up a half-inch or three-quarter-inch—or even a larger—core and finding the vent hole coming out at the side about half its length; and no one but a core maker knows how difficult it is to push a crooked wire through a half-inch core six inches long, and keep it away from the side of the box. Having, not long since, occasion—as I thought, sufficient—to give a lad a sound rating for running vents out at the side of cores, I felt at the same time self-accused when it was so simple a matter to avoid all trouble in that direction. A guide for the wire was what was wanted, and here it is; simply a spool-shaped casting, two inches long, with a hole through it to let the vent rod or wire pass through easily. The hole must be at right angles with the ends of guide, and the end of core box square and at right angles with core.

The device works to a charm, and by its use a $\frac{3}{16}''$ wire can be put through the center of a half-inch core, every time. The operator can't go wrong if he starts in center of core and holds the guide firmly against core box.

A word about the vent wires. The ordinary kind, full of short (and long) crooks will not do. I use Stubbs' steel and keep them straight.

FOUNDRYMAN.



Defective Settings.

In the November number of the *Locomotive*, published by the Hartford Boiler Insurance Company, we find the following excellent hints for users of steam boilers, which should be carefully read, and the suggestions put into practice:

"*Defective Settings* are one of the chief sources of loss and waste of fuel in boilers of the external fired type. The reasons for this are various; the chief ones are faulty design and faulty construction; faulty design preventing the perfect combustion of the fuel, and faulty construction being responsible for cracks, leaks, and air holes in the walls of the setting, flues, and chimney, whereby cold air is drawn into the furnaces at the wrong places, thereby lowering the temperature of the products of combustion; and into the flues and chimney, impairing the draft, and very greatly reducing the efficiency of the whole arrangement.

"Too much care cannot be taken with the brick work of boiler settings. The brick should be carefully laid, the joints should not be too thick, the mortar should be of good quality. A hollow wall should always be built for the side and rear end walls, with a two-inch space between them. Some engineers recommend a solid wall, for the reason that two inches of brick work is a better non-conductor than two inches of air. This may be true, if we take simply a brick wall two inches thick, and compare it with a film of air two inches thick. But the air space between two walls is a different thing. It breaks the *continuity* of the wall, and is consequently of greater value than at first sight appears. But its greatest value consists in the fact that it gives us two walls (which, of course, should always be laid up independently, or at least *not* tied rigidly together). The inner one exposed to the fierce heat of the furnace, takes any distortion or cracking which may result, while the outer wall remains comparatively cool and intact, and consequently prevents the sucking in of cold air through the cracks, which *will* occur in the inner wall and *will* extend entirely through the whole wall if it is solid, whatever practicable thickness may be given to it. A small crack in the setting of a boiler, which gives the air a chance to draw in through the joints into the furnace or flues, results in a greater loss of efficiency than most people are aware of. One of the most fruitful sources of loss from this cause occurs when boilers are set with a 'flush front' setting. The walls always expand and force the front away from the end of the boiler. When the front becomes bulged out, the entering air, instead of all going through the fuel, takes a short cut up between the front and the brickwork, directly into the smoke connection. It is surprising how much effect half an inch of space between front and wall at this place will produce. We have found many cases where it was impossible to make steam from this cause, and the source of the trouble was entirely unsuspected until it was pointed out by an inspector. Boilers set with a 'projecting front' are not subject to this defect."

Important Railroad Extension.

The Burlington, Cedar Rapids, and Northern Railway Company have ordered ten new ten-wheel locomotives from the Pittsburgh Locomotive Works, and five of the same kind from the Brooks Locomotive Works. This company has arranged to extend its Pacific division north from Worthington, Minnesota, to Bismarck, Dakota, where it will make connection with the Northern Pacific Railroad. The Burlington, Cedar Rapids, and Northern is the Albert Lea route, controlled by the Chicago, Rock Island, and Pacific Railway, and the new extension will give Chicago a direct connection with a wide Northwestern territory. One or two unfinished branch lines will be completed next season, which will make important feeders to the main line. Work on construction will begin so soon as the weather will permit, and it is calculated that two hundred miles of new track will be in running order before snow flies. In addition to the locomotives now ordered the company will want about twenty more next season.

Baldwin Shops Will Not be Moved.

An item has been going the rounds of the press which asserted that the Baldwin Locomotive Works, of Philadelphia, had purchased land in West Virginia for the purpose of building shops there. We doubted the truth of this report, and wrote the Baldwin Locomotive Works asking for information. They replied: "The report referred to is unfounded. We have no intention, nor have we at any time intended, to move our works, or establish any branch shop outside of Philadelphia."

Personal.

William M. Barr has resigned, as Superintendent of the Cummer Engine Company, Cleveland, O., to accept the position of Superintendent of the Henry R. Worthington Hydraulic Works, Brooklyn, N. Y. Mr. Barr will exercise his well-known ability in directing the employment of the seven hundred and fifty mechanics, who are working in that establishment.

When Men of Sense Will be "Practical Free Traders."

The *Boston Commercial Bulletin*, which has heretofore favored the policy of a protective tariff as a *principle* rather than as a makeshift, has joined the agitators for a gradual approach to free trade, as may be seen from a perusal of the following paragraph, with which it concludes an editorial:

No doubt a further reduction can be made in the tariff without serious disturbance to the industries of the country, and at the same time result to their permanent advantage. Cautious and conservative methods must be used in reaching this end. Mr. Carlisle himself declares that he would not make radical changes in the tariff at once. It is well, for public sentiment is not in favor of an abandonment of a judicious policy of protection. The period is not very remote when a tariff for revenue only will be expedient, just as now a tariff for protection is expedient; that time will come, and when it does, men of sense will then be practical free traders, for exactly the same reason that they are now practical protectionists.

We saw at one time a moulder make use of a foundry for purposes not intended in the original construction. A propeller shaft came to the works, upon the end of which was a coupling, shrunk and keyed in place. The key was removed, but the coupling refused to be persuaded off by any means at hand. The machinist mounted the job on a car, the coupling projecting over the end, run it into the foundry (it was pouring-off time), and got a couple of moulders to pour each a hand ladle of hot iron slowly over the coupling, letting it run off on the sand. After this the coupling was removed by the use of a small sledge.

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"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, DECEMBER 29, 1883.

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With this issue, the last number of Vol. 6, we publish a six page index, which is folded in (loose) with each copy. It will be found a convenient guide to the contents of the fifty-two numbers of volume. We have been asked by several readers why the AMERICAN MACHINIST is not paged continuously from the first to the last number of the volume. The reason is, that our policy has always been to make each number, as nearly as practicable, complete in itself. There are no continued articles. Each article of a series is complete in itself, and readers may begin with any issue of the paper during the year, and get the benefit of its whole contents and all that follows without going back to the beginning of the volume to find an intelligible starting point. Therefore each number is paged independently. Our readers will find no difficulty in using the index, as each article is referred to by date of issue and number of page.

Learning the Machinist's Trade.

A good deal of misapprehension exists in the minds of boys desirous of learning the machinist's trade, or engaged in learning it, about the advantages and disadvantages of different shops. There seems to be an opinion almost universal that the trade, as practiced at present, can only be learned in some large manufacturing establishment, provided with all modern tools and facilities for doing work. This is all a mistake, but it undoubtedly prevents many desirous of working at the machinist's trade from entering some less pretentious shop, through waiting for opportunities in the larger shops—opportunities that never occur. Not only this, but many boys who do enter the smaller shops work all through their time under the discouragement of the belief that in the proper sense they are not learning the trade. While many large modernly-equipped shops afford good opportunities for wide-awake boys, alive to their interests, it is, beyond much question, a fact that as a rule the small shop—the genuine machine shop—affords better opportunities for the same class of boys. There is a wide difference, and this is generally lost sight of, between learning to use machine tools and learning the machinist's trade.

We have now before us a letter from a young man in one of the Southern States, in which the writer says he is serving an apprenticeship in a machine shop, but that he is learning nothing of the use of many of the modern machine tools in common use in Eastern shops; in fact, that he knows nothing of such tools except what he reads, and he doubts the propriety of working three years to learn the trade in that shop. He writes that with such tools as they have they are expected to do, and do, good work. In this sentence he gives the best possible reason for remainng at least three years, and unconsciously gives the shop the best possible character as a place in which to learn the machinist's trade. Managing to do good work is exactly what constitutes a good machinist, and managing to do it with tools that require a good deal of planning to get good work from, however it may be for the proprietor, is very fortunate for the boy who has to use them. A man who can build a good steam engine, or any other machine, with tools best suited to the purpose is a good machinist, but the man who can do the same with poor tools, ill-suited to the purpose, is something more than a machinist.

This being obliged to contrive ways and means, as well as to do the work, is one of the advantages that a boy is likely to get in the small shops, and in the future this will generally outweigh the advantages of the use of special tools acquired in the better-appointed shop. In fact, the use of special tools is something the apprentice in the small shop, where he is required to do good work, need never trouble himself about. He will never need *learn* to use them. When the opportunity comes, he will use them without learning. Learning the machinist's trade is learning to do machine work with the tools and appliances at hand, and the best part of it—in fact, about all of it—is in knowing how to adapt means, good or bad, to an end.

Another point upon which mistakes are frequently made is in attaching undue importance to the kind of work done in the shop. There is no objection to following one's inclination in this matter when it can be done about as well as not, but the real objective point is to learn to shape metals, and it will not, in the future, make any material difference whether the pieces shaped go to make up a steam engine, or an engine lathe, or something else. Any boy desirous of learning the machinist's trade cannot do better than to make up his mind that he can do it about as well in one respectable machine shop as in another. There will not be enough of the glory of the best shop in the world stick to him to seriously affect his future career. After he has concluded his apprenticeship, there will be time enough to indulge his inclination to work at some particular branch of the trade.

One other thing, brought up by a letter from another young man, who writes that he has worked two years of his time, but fears he must leave because the pay is not sufficient to support him. Such a course is always unfortunate, and it is to this more than to anything else that many machine-shop proprietors are not willing to employ apprentices. There are many advantages in being a good machinist, and to gain them a young man should make any reasonable sacrifice. It is a poor beginning to only half accomplish what one sets their heart on doing, and especially not to do what one agrees to do.

Street Car Starters.

A great deal of ingenuity has been expended on the invention of street car starters. A man of humane tendencies watches the horses tugging and straining to get a car started, and he naturally thinks it would be a relief for the horses and a fortune to the inventor who could devise an appliance which would absorb the work done in stopping a car and give it out in starting. The more this philanthropist thinks of the car starter, the more convinced he becomes that he is in the way of preventing cruelty to horses, and of laying the foundation of his own fortune. It does not take long to plan a spring arrangement which can be wound up by the moving car which it tends to stop. Then he gets the device through the patent office, but in the meantime the discovery is made that a multitude of inventors have already been in this field. However, inventors are a hopeful race, and the man with the car starter consoles himself with the reflection that his invention is a little better than anything previously developed in this line. If he prove very persistent and persevering he manages, after much discouragement, to have his starter tried on a car. Somehow it does not give out all the power expected, so there must be something that needs adjustment, and the device is taken off for the purpose, but it is not put on again. Meanwhile, other men are seized of the same idea and a similar cycle is traversed.

The parties who bring out the car starters work on a mistaken notion. They know there is a good deal of power lost in stopping a car, and they think most of it can be preserved, which is a mistake. If the stopping appliance caught the car at its highest speed and destroyed the velocity within a foot or two, it might receive nearly the whole of the energy that was in the moving car. But this is not practicable. The device must stop the car by degrees, and in the space passed over a considerable per centage of the energy is dissipated by the wheels rubbing on the rough track, and the friction of the apparatus absorbs some power. When the losses are all summed up there is very little energy left in the spring to be available for starting the car. In places where cars run down steep grades where they require braking, there may be a possibility of absorbing energy enough to be useful in starting or even in helping the car up another hill; but for ordinary stops on a level, no power can be preserved which will pay for the apparatus.

Loss of Trade Through Drunken Mechanics.

A report comes from Glasgow, Scotland, which indicates that the Clyde ship building and machine trade are losing orders through a cause very discreditable to the workmen. When work is brisk in that district and wages high, a great many of the mechanics are in the habit of remaining out on drunken bouts for two or three days each week. Many of the very best hands indulge in this practice. It has become so serious as to interfere with the regularity of builders in finishing orders, and several cases have recently happened of work going to continental firms because those of the Clyde could not be relied upon to finish the contracts on time. The trade unions have done all they can to discourage the prevailing practice of periodical spreeing among members, but they do not seem to effect much good. The real trouble is, that drunkenness receives too much apology in all quarters of the British Isles. There may be some improvement now, but we know that twenty years ago, nearly all British machine shops had certain good workmen who might be depended upon to go on a drunk when their services were most needed. And in many cases the whole shop would be inconvenienced till they were pleased to come in. The fashion there was to tolerate this nuisance. The fashion in this country of discharging men who display greater attention to whisky than to their work is better for all concerned. Changing men on certain jobs, may cause great inconvenience in a shop for a few weeks, but it is better to endure that than the continual annoyance of recurring periods of absence through dissipation. If the Clyde ship builders and engineers would adopt the American policy of dealing with drunkeness they would effect its cure after a time.

Since the adoption of the new standard time, numerous applications have been made to the U. S. Patent Office for a patent on clock dials and other devices intended to present the whole twenty-four hours of the day in a convenient manner and without crowding the figures. The applications have been nearly all rejected upon evidence found in an old record that Prince Soltykoff possessed a watch made in 1547 with the whole twenty-four hours arranged in concentric circles.

The mine inspectors' reports of accidents in the Wilkesbarre (Pa.) district show that in the eleven months of this year there have been 539 accidents, of which 89 have been fatal. This is an increase of 100 accidents over those of the corresponding period last year. From this record, it does not appear that inspection is an eminent success, so far as preventing accidents is concerned. A great many of the accidents occurred through defective machinery, which is certainly avoidable were proper care exercised. What is wanted to prevent accidents of this character is the holding of responsible parties to more intimate acquaintance with the punishment due to the crime of manslaughter or criminal carelessness. One of our pretended religious contemporaries recently urged a new Arctic expedition, belittling the previous loss of life on the plea that human life is cheap. It is exactly sentiments of this kind that permit the appalling slaughter of men engaged in industrial pursuits to go on unchecked. There is an increasing massacre of brakemen through defective couplings and wickedly-designed cars; defective machinery, operated by incompetent men, sends annually an array of miners by violence to their last account; rotten, worn-out boilers are daily spreading death and mutilation among helpless citizens, and absolutely nothing is done to prevent this recurring carnage. And nothing will be done till the workmen supplying the victims arouse themselves, and have laws passed that will bring the guilty parties to speedy justice.

High Price Paid for Setting Valves.

Mechanical skill seems to be at a discount in Nicaragua. A short time ago a small steamboat was brought from England in sections and put together in Nicaragua for use in an inland lake. When the engine was set up, it was found that no man round knew how to set the valves. The engine had a link motion and several attempts by novices at setting the valves ended in humiliating failure. They could not get them near enough to the correct position for the engine to move, and by force the boat remained idle. The owners were in a bad fix, and they were contemplating sending a long distance to Manuagua for a man to set the valves, when an American engineer on his way to visit the United States, happened at the place where the boat was lying. This engineer had to remain at that point three weeks waiting for passage to the North; and the owners of the steam boat offered to pay his hotel bill and give him $180 in gold to set the valves of their engine. The offer was accepted and the work done satisfactorily in one day, and the engineer, who recently visited this office, thinks he was paid the highest price for valve setting of any one round.

There is a very decided feeling among business men and capitalists that this is a good time to buy and hold; to buy pretty much anything of intrinsic value, whether it be pig iron or wheat, land or factories. They are all cheap now, and so they were in the early part of 1879, but then in a few months everybody was on the bull side and bears were hardly known.—*Baltimore Manufacturers' Record.*

The best time to buy merchandise, land, or factories, is when the property is wanted. There never will be a good time for business men to turn speculators.

Machinery has hitherto done comparatively little to lighten the arduous toil of coal-mining. The underground coal workers are peculiarly conservative about their methods of doing work, which may partly account for the lack of enterprise in that department of labor. But there are also extreme difficulties encountered in successfully applying machinery in coal workings. We observe that a Leeds, England, firm control patents for coal-working machinery which they are pushing before those interested in the business. The machine is moved on rails to the front of the coal, and a serrated bar, operated by a swinging hammer, acts as a pick. Machinery has been used so successfully in all other lines of mining, that we do not see why it should not be utilized for coal.

We have received a letter from Mr. F. W. Dean, expressing regret that we published in a recent issue a paragraph containing part of a private letter, he wrote about the Joy valve gear. He says the letter was hurriedly written to a friend, after a tiresome journey, and his observations were not scientifically exact enough to do justice to any of the parties concerned. The letter was sent in to us for publication, or we should not have used it, and we regret that it has given annoyance to any one.

Secretary Chandler does not think that this country needs a great navy until we become foremost in the possession of a mercantile marine. But he concurs in the recommendations of the Advisory Board of the Navy for the immediate completion of the double-turreted monitors, and the construction of new steel cruisers. In his opinion, the immediate object of the Government should be to replace our worn-out cruisers with modern vessels fitted for general service. He advises the construction of one steel ram and three torpedo boats, these being part of a number of vessels recommended by the Advisory Board last year and the year before last. He considers the vessels available for actual service are insufficient to give training to the officers and seamen, and advises the policy of building at least seven new ships annually during the next ten years.

In the Loan Art Exhibition now open in the rooms corner of 23d Street and 4th Avenue, New York City, there is a Swiss cross-bow made in the 15th century, which has a bow of cast steel. This is drawn back by rack and pinion, with teeth as well cut as any machine work of the present day. Another steel bow of more ancient make, is drawn back by a gut rope worked by pulley-blocks. The mechanical finish of much of the ancient armor shown in this Exhibition would do credit to the skill of modern machinists. The inlaid metallic work executed as far back as the 15th century, gives evidence of patient skill that is seldom paralleled in the present day.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(409) C. O. S., Chicago, Ill., writes: I have a machine that I wish to get patented in the United States and England. How can I do it? *A.*—The best plan is to apply to a reliable patent attorney.

(410) A. S., St. Louis, Mo., asks: How can I obtain full information about all patents issued on any class of machinery? *A.*—By carefully searching the *Official Gazette*, or printed records of the Patent Office, which may generally be found in large public libraries. It would be quite a serious undertaking.

(411) W. J., New York, asks: Can you tell me how japan and gilding is put on iron work? *A.*—The articles to be japanned are cleaned of oil, usually by the use of turpentine, and the japan varnish applied, when the articles are placed in a hot oven to dry. To gild japanned articles, the part to be gilded is covered with oil size, thinned with turpentine, and gold powder put on with a puff. This is then varnished, and moderately heated in the oven. Leaf gold may also be applied in the usual way.

(412) J. N. B., Columbus, Ohio, writes: I am working in a railroad shop, and some of the old hands make sport of using oil in filing wrought iron. I and one of my fellow workmen were taught to use oil by good authority. Please give your opinion. *A.*—Oil is sometimes used to advantage in fine filing wrought iron and steel. Much depends upon the kind of file used. Some workmen make considerable use of oil in this way, while others scarcely ever use it. The individual judgment of the workman must decide whether or not he can get better results by its use.

(413) J. S. K., Philadelphia, Pa., asks: How can I put my name on hardened steel tools? *A.*—Mix one ounce nitric acid with about one-sixth as much muriatic acid. Clean the article of oil, and cover it with a film of melted beeswax; then, with a sharp point write on the wax, being careful to remove the wax down to the steel where the letters are to come. With a feather or small brush apply the acid, filling the letters. Let it remain about five minutes, then dip in water to stop the acid eating. To get the right time of exposure, and a little practice, it will be well to practice at first on something of no value.

(414) G. C., Louisville, Ky., asks: How many revolutions per minute may a pulley 54″ diameter, regular pattern, be run safely, and is it more dangerous with the belt on than off? *A.*—"Regular pattern" is indefinite. A 54″ pulley should run safely at 500 revolutions, but whether it will do so depends not only upon the quality and distribution of the metal, but upon shrinkage strains, and things that cannot be determined until the pulley breaks. If properly proportioned, and a smooth running belt used that does the work without undue tension, there will be but little difference, so far as breaking is concerned, whether the belt is on or off.

(415) S. Q., New York, writes: I am so situated as to require the back gears of my lathe to be nearly noiseless. The gears are 42, 98; 42, 98, the larger ones about 6″ diameter. The lathe is 10″ swing. Can two of these gears be made with wooden cogs? If so, I would willingly renew them once in six months. My lathe is only used for amateur work, perhaps in the aggregate 60 days in the year. *A.*—We do not think it practicable to cog gears of so fine pitch. It is probable that, by sending the head so that the alignment can be corrected if necessary, that you can, at some shop that makes a specialty of fine gear work, have a set of gears made that will run substantially noiseless. This is the only remedy we can suggest.

(416) A. E. S., Lockport, Ill., writes: 1. I wish to move a piston one foot in a cylinder by heating the air in the other end. What room shall I require in the end in which I heat the air? *A.*—You do not state against what resistance you wish to move the piston. You cannot do work, practically, in this way. If you leave a space one foot in length, by heating the air to 500° you will move the piston, but not against much resistance, and the operation will be very slow. 2. What pressure of air is used in caloric engines? *A.*—Different pressures, usually only a few pounds above the atmosphere. 3. What proportion of air and gas is used in a gas engine, and what is the pressure when the mixture is exploded? *A.*—About 12 of air to 1 of gas; pressure in some cases more than 200 lbs. per square inch.

(417) M. J. B., Yarmouth, N. S., asks: How is it that trains in England running at a high rate of speed approach a railway station so rapidly and stop so suddenly, notwithstanding that there is but one man (the guard) to apply the brakes? *A.*—If there is only one brake applied by a guard, the train does not stop suddenly from a high rate of speed. Until continuous brakes were introduced, express trains in England were seldom stopped in a shorter distance than half a mile. Hence the practice there of placing "distant" signals to protect stations.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Special Machinery—G. D. Lambert, New Haven, Ct.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

"Tack Machinery"
Willets Manufacturing Co., Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Slide Valve Working Models. Send for circular. See notice in this paper, October 13, page 9. E. E. Roberts, 107 Liberty Street, N. Y.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

The "Wax Process" engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

"Painting and Painters' Materials."
The best book for all who paint, deal in paint, or have painting done. $2 25. For sale by "The Railroad Gazette," 73 Broadway, New York.

H. O. Reinhardt, M. E., Member of American Society of Mining Engineers, Chihuahua, Mexico, invites correspondence of manufacturers of machinery who desire to introduce same in Mexico.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Corliss Steam Engines at a bargain. One 12″x42″; one 16″x36″; one 20″x42″. All in first-class running order. Henry I. Snell, 135 N. 3d Street, Philadelphia, Pa.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

Wanted—Second-hand iron planers, large swing screw-cutting lathes, and drill presses, in good order. Parties having these for sale or exchange for new machinery, please address, with full description, maker's name, and bottom cash price, W. A. James & Co., 275 So. Canal St., Chicago, Ill.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Wanted—A purchaser for the rights (free of royalty) to manufacture and sell the Noteman Rotary Engine in the Eastern and Atlantic States. Comparative tests with the best reciprocating engine as to economy of steam, &c., by Prof. Robt. H. Thurston at Stevens Institute, can be had on application to D. E. Saltonstall, 86 John St., N. Y.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

EXTRACTS FROM CHORDAL'S LETTERS, containing nearly 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with additional illustrations, many of them humorous and all effective - over 50 in all. Just the thing for a holiday or birthday gift. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

The Gardner Governor took first prize at the Louisville Exposition.

Three thousand dollars have been subscribed towards the erection of a cotton-seed oil mill in Saluda, S. C.

New Orleans wants a sash, door and blind manufactory on a large scale, with a capital of not less than $100,000.

H. C. & J. H. Calkins, coppersmiths, 256 West Street, New York, will soon build an addition to their shop 22x40 feet.

Greenville, Pa., citizens are raising $13,000 to induce Pierce & Son, Harmony, Pa., to remove their woolen mill to that place.

S. Roebuck & Co., 164 Fulton Street, New York, are about to erect works in South Brooklyn for manufacturing weather strips.

The silk manufacture in Paterson, N. J., is very dull, yet operatives are every week coming from Europe, where the business is duller yet.

The Suffolk (Va.) Cotton Mills Company have begun the erection of a brick annex to their factory, to increase the capacity of their mill.

Richard Walter is to erect a two-story brick factory, 52x258 feet, corner Railroad Avenue and 166th Street, New York, at a cost of $30,000.

Strauch Bros., 116 Gansevoort Street, are to add one story to their piano action factory, 77x100 feet, on Tenth Avenue, making it four stories high.

A six-story brick factory, 50x95 feet, is to be erected at 118 and 120 West Houston Street, New York, by Ellen E. Ward. Its cost is to be $40,000.

A new factory building, 104x100 feet and three stories high, is to be erected on 106th Street for Wm. Hall's Sons, of 522 East Twentieth Street, New York.

Maria L. Olliffe, 130th Street and Sixth Avenue, New York, has obtained a building permit to erect a six-story brick factory, 67x90 feet, on West Thirty-fifth Street.

The American Watch Company, at Waltham, Mass., will require 3,500 employes to produce 1,800 watches per day, this number to be made as soon as possible.

The Leader Sewing Machine Company, of Cleveland, O., have completed their new shops. They will use a Westinghouse automatic engine of 60 horse-power.

The Cleveland, Columbus, Cincinnati and Indianapolis Railroad Company will soon build new shops at Linndale, seven miles from Cleveland, where it owns a large tract of land.

Cleveland has been given an opportunity for securing the location of safe works. James White, of Canton, is the projector. It is proposed to expend $50,000 in the plant.—*Cleveland Trade Review.*

The Gregg Brick Machine Company, Chicago, Ill., has been incorporated by Wm. S. Gregg, Henry W. Farnham, and Asahel Bennett, with a capital of $1,000,000, for manufacturing the Gregg brick machines.

The St. Louis *Age of Steel* says: "The Laclede Rolling Mills have not shut down, as has been reported, but are running their sheet and plate departments day and night. No idea of closing has as yet been entertained."

The citizens of Marshall, Mich., are paying the $70,000 they subscribed to aid in the construction of the Michigan and Ohio Railroad, and for the construction of the repair shops of the road in that city. Work on the shops will be commenced at once. The contract for building them has been let to Thomas Hamilton.

The Lambertville (N. J.) Iron Works (John Finney, Prest, and Ashbel Welch, Treas.) issue a circular informing the public that they have purchased the interest of Mr. Ashbel Welch in the Lambertville Iron Works, and will continue the business as heretofore conducted, including the manufacture of the Lambertville automatic cut-off engine, which has achieved a good reputation; also other engines and machinery.

The Boston *Commercial Bulletin* says: "Josiah Gates & Sons, of Lowell, are now making the largest belt ever manufactured in that city, for the flouring mills of the Pillsburys at Minneapolis, Minn. It is 160 feet long, 54 inches wide, and five-eighths of an inch thick, being of three thicknesses of leather, and the middle one shaved down to make the outside layers more compact with it. The belt will weigh about a ton. It was ordered to be delivered in ten days."

The Winchester Arms Company of New Haven, the Union Metallic Cartridge Company of Bridgeport, and the United States Cartridge Company of Lowell have combined, and will in future act together as a syndicate, controlling the cartridge manufacturing of the country. The Union Company of Bridgeport employs 1,500 men, and the Winchester Company nearly as many, independent of a large number working on guns. W. W. Converse, president of the Winchester Company, will be president of the new concern.

Machinists' Supplies and Iron.

NEW YORK, December 13, 1883.

There is no change in the supply business.

In American iron we quote No. 1 X Foundry $20.50 to $21; No. 2 X, $19 to $20.

Scotch pig is inactive, with sales of Coltness, $22.50; Glengarnock, $21 50; Gartsherrie, $23; Summerlee, $22.50; Eglinton, $20 to $20.50.

Antimony rules steady at—Hallett's, 10¼c.; Cookson's, 11¼c.

Copper—Lake, 14⅞c.; other brands, 14⅛c. to 14⅝c.

Lead—3.65c. to 3.70c.

Spelter—Refined, 8c. to 8¼c.

Tin—Banca, 21½c.; Straits and Malacca, 18¾c. to 19c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

An experienced mechanical draughtsman is open for engagement. Address B., BOX 10, AM. MACHINIST.

Wanted—Situation as superintendent or engineer. Reference given. Address, A.B., care AM. MACHINIST.

Wanted—By a machinist, situation as foreman or superintendent. Best of testimonials as to character and ability. Box 428, Fitchburg, Mass.

Wanted—A capable, energetic mechanic, as foreman for a heavy machine shop. Address Williamson & Barker, 68 Washington street, Chicago, Ill.

A thoroughly practical mechanical engineer of long experience desires an engagement. Address B. J., BOX 5, AM. MACHINIST.

Young mechanical draughtsman wants position; understands blue copying; references. P. O. Box, 3540, N. Y. City.

Wanted—Situation as metal pattern maker, or as assistant in foundry; ten years' experience in malleable iron works; references given. Address Pattern Maker, 266 Congress Street, Lansingburgh, N.Y.

First-class mechanical draughtsman, graduate; of long experience; able to construct any kind of machinery and superintend building of same, desires situation. Address E. H., AM. MACHINIST.

Wanted—A situation, by a mechanical draughtsman; has had a good general experience, and can handle men to the best advantage. Address Square, AMERICAN MACHINIST.

Wanted—A situation as foreman, by a pattern maker of 20 years' experience. Well acquainted with all classes of foundry work; is a good draughtsman, and accustomed to handle men. Best references. Address Experience, AMERICAN MACHINIST.

A practical man, experienced in the management of a machine shop, wants a situation. Steam engines or general jobbing much preferred. Expectations not less than $1,200 a year. Would put skill against capital. Correspondence solicited. Address F. J. Masten, Box 312, Pullman, Ills.

Wanted—Re-engagement by a practical machinist and draughtsman of 18 years' experience, principally engaged in designing new machinery; some electrical knowledge; instructor in school of Art during 11 years. Address R. B., care of Mr. John Frazer, Methuen, Mass.

A first-class mechanical engineer and draughts man, with 20 years' experience in the designing and building of automatic engines, boilers and general machinery; and as manager and superintendent, is open to an engagement. Best of references. Address—R 42, AMERICAN MACHINIST.

Wanted—A first-class mechanical draughtsman for a machine shop in Chicago. He must have had experience, and be capable of figuring materials. He must also be active, and not over 35 years of age. A good salary and a permanent position to the right man. Address C. C., Box 12, care of AM. MACHINIST, giving experience and references.

Draughtsmen—Wanted, several first-class men to work, under direction, on designing new machinery of a high class. Engineering knowledge is essential, and should, if possible, include training both in theory and practice. Address, stating age, references, past experience and compensation expected, W. E. Y., Box 4, AMERICAN MACHINIST.

Wanted at once—Two first class experienced mechanical draughtsmen. Experience considered as first qualification. Foreigners who cannot talk and understand English will please not apply. Address, giving full particulars, as to years of practice, character of work done, wages expected, &c., Brown & Sharpe Mfg. Co., Providence, R. I.

Wanted.—Good second-hand boiler maker's Punch, shears and rollers. Give lowest cash price, and full description. Sulzer & Vogt, Louisville, Ky.

Amateur Mechanics—Model engine castings, stationary, locomotive, and marine, from $1.75 per set. J. Gilbert, 211 Tenth Avenue, New York.

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The most perfect and efficient rotary motor yet produced, constructed on strictly hydraulic principles, the inventor and patentee of which desires to obtain capital to manufacture, or to place the patents in the hands of some responsible manufacturing firm to manufacture and introduce it. As a sewing machine motor it is absolutely perfect, and especially adapted to run all kinds of comparatively light machinery, such as job printing presses, turning lathes, spice mills, dynamo-electric machines for telegraphic, telephonic, plating, medical purposes, &c., and the infinite variety of that class of machinery in which field there is a pressing demand for a cheap, safe and efficient light power. Some of these motors are on exhibition, "and will be for a short time only," at No. 40 Fulton Street, Brooklyn, running sewing machines and a dynamo-electric machine. To verify the above claims, call and examine. Correspondents address Wm. J. Gurd, 40 Fulton Street, Brooklyn, N. Y.

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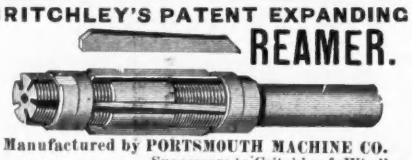

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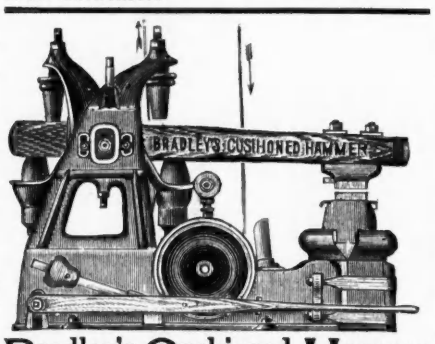

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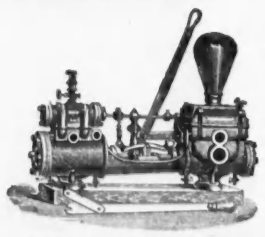

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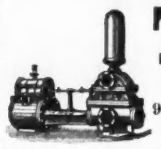

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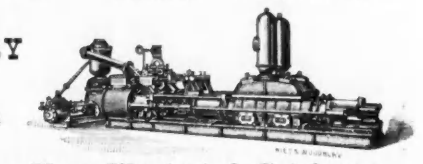

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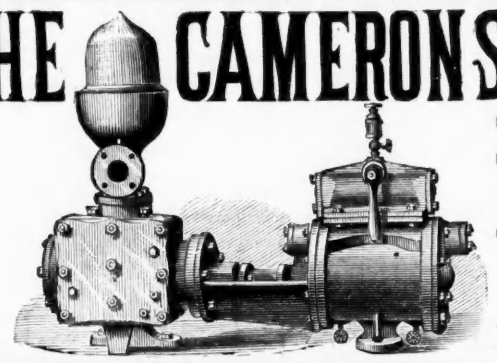

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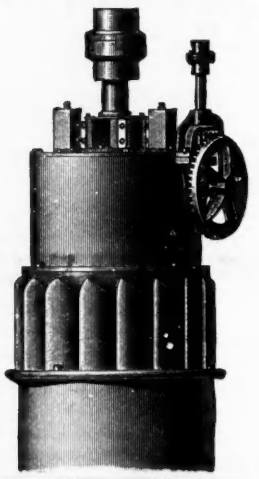

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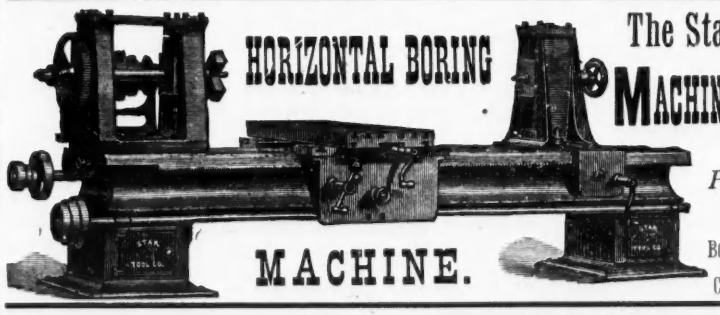

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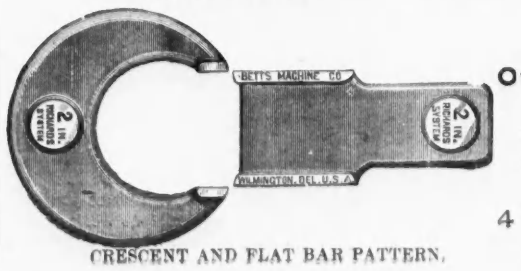

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ANY Size from ¼ inch to 6 inch.
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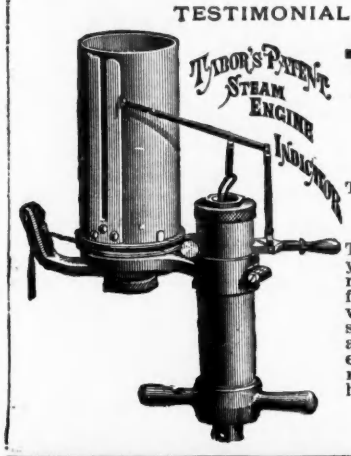

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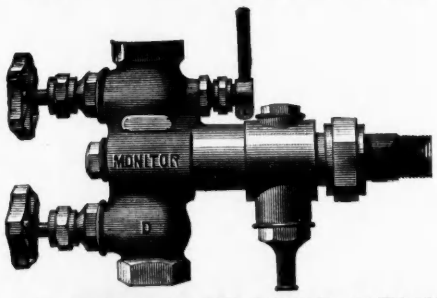

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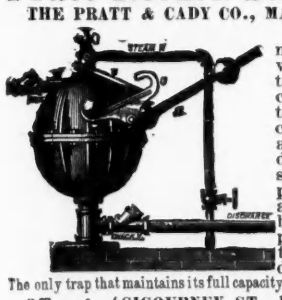

This trap automatically drains the water of condensation from heating coils, steam radiators, drying machines, boiling pans, and wherever condensation occurs in steam pipes under pressure (whether above or below the boilers which supply the steam), returning the same direct to boiler.

The only trap that maintains its full capacity when pressure is reduced.

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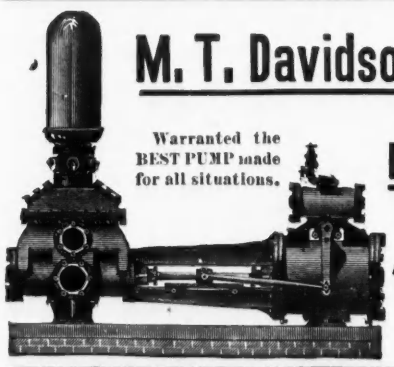

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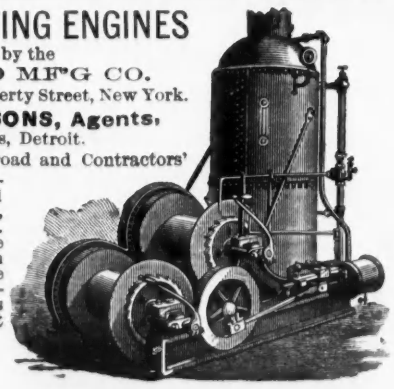

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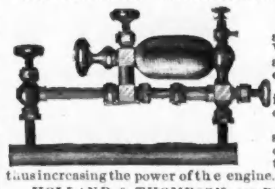

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This dog is very heavy, and is warranted not to break with any work

No. 1	3-8	in.	$ .50
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" 4	3-4	"	.70
" 5	7-8	"	.80
" 6	1	"	.80
" 7	1 1-8	"	.95
" 8	1 1-4	"	.95
" 9	1 3-8	"	1.10
" 10	1 1-2	"	1.10
" 11	1 3-4	"	1.25
" 12	2	"	1.40
" 13	2 1-4	"	1.60
" 14	2 1-2	"	1.60
" 15	3	"	1.80
" 16	3 1-2	"	2.00
" 17	4	"	2.30
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Full set, 19 Dogs, 26.35

No. 20	5 1-2	in.	4 25
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When ordering, state as above, whether a full set or a set of 12 or smallest of a. Users of these dogs prefer them to any other make.

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Small set of 8 dogs from 3-8 to 2 in., $7.30.

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PATENT HOT POLISHED SHAFTING.

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Sizes made from 7/8 to 3 1/4 inches, advancing by sixteenths.

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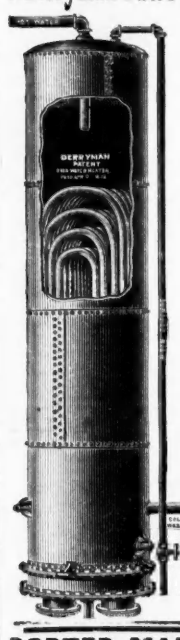

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HARTFORD, CONN.

Has seamless drawn brass tubes. The **U** shape of the tube prevents their being affected by expansion or contraction.

This Heater has been in constant use Ten Years.

None have ever required repairs. Gives the highest results attainable by the use of exhaust steam.

IT IS ALSO THE ONLY HEATER APPLICABLE TO CONDENSING ENGINES, increasing the vacuum and imparting a high degree of heat to the Feed Water.

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The Baragwanath Steam Jacket Feed Water Heater & Purifier.

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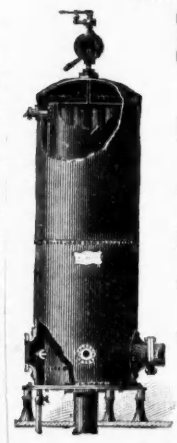

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Best Feed Water Heater IN THE WORLD.

Delivers Feed Water several degrees above Boiling Point.

Reduces Back Pressure on Engine

Prevents and Removes Scale and incrustation from Boilers.

SAVES FUEL.

Increases the Steaming Capacity of Boilers, and saves Boiler Repairs.

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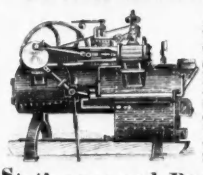

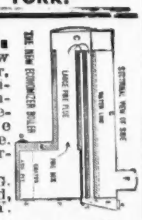

The New Economizer, the only Agricultural Engine with Return Flue Boiler in use. Send for circular to PORTER MFG. Co., Limited, Syracuse, N.Y.

Stationary and Portable Boilers and Engines. Iron and Steel Boilers. Power and Steam Pumps.

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RUBBER STAMP MAKERS TOOLS & SUPPLIES BARNES & ALLEN SYRACUSE, N.Y.

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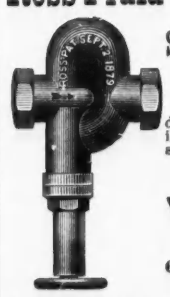
Ross Fluid Pressure Reducer,

FOR

Steam, Water, Air and Gas.



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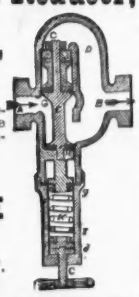

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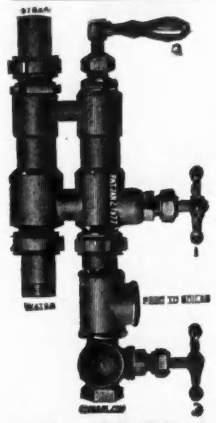

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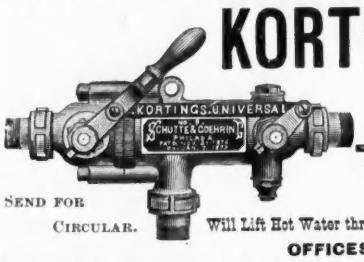

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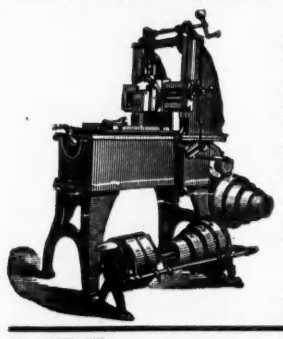

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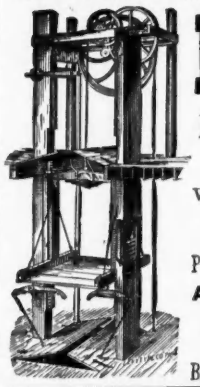

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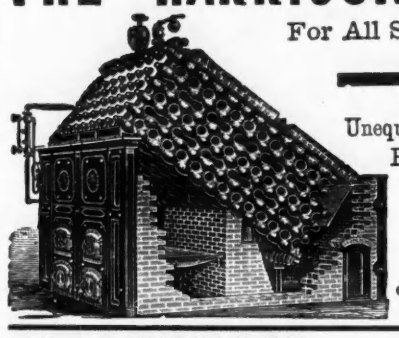

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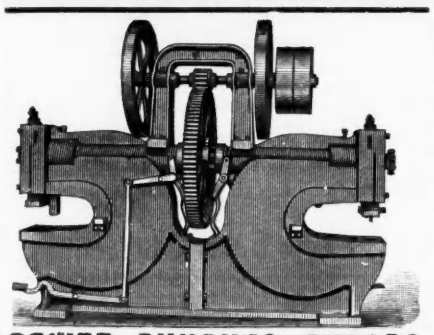

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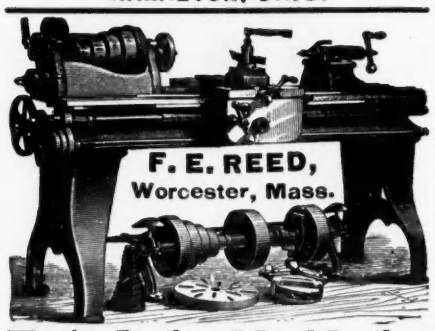

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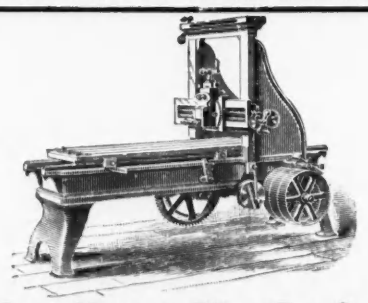

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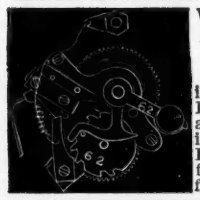

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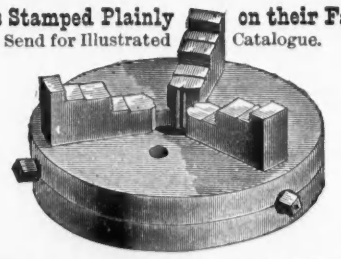

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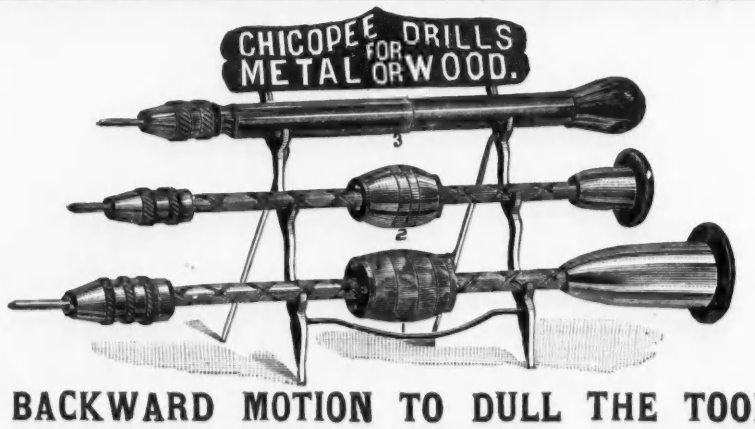

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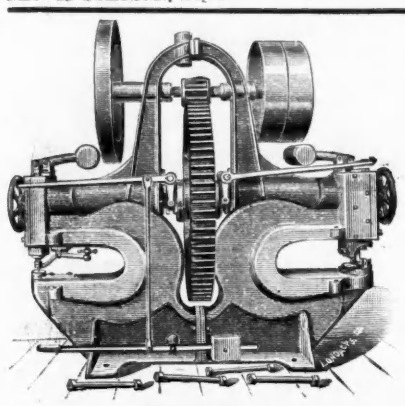

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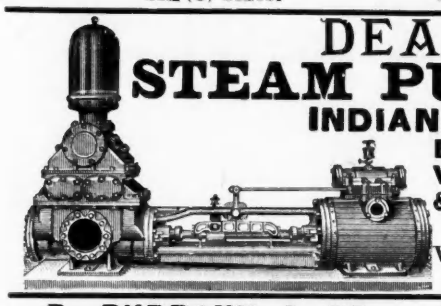

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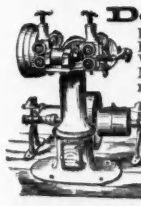

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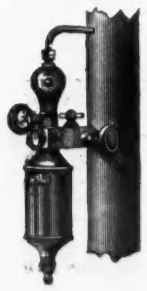

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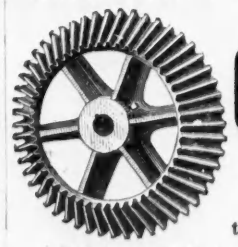

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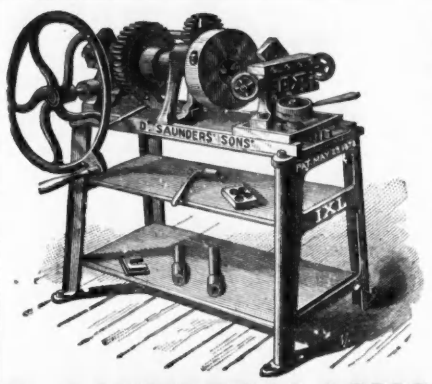

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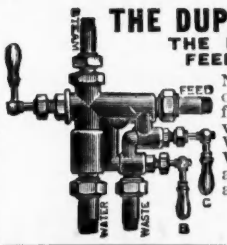

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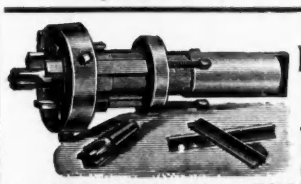

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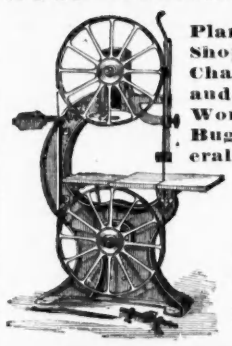

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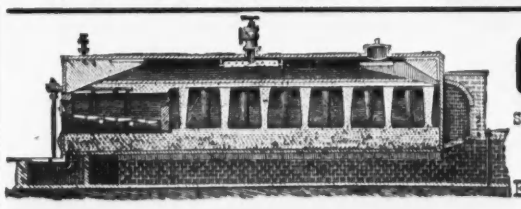

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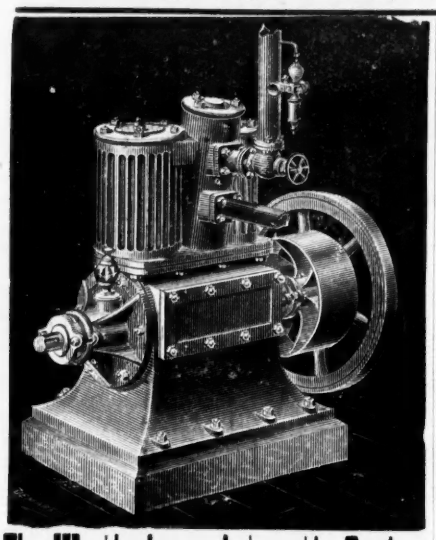

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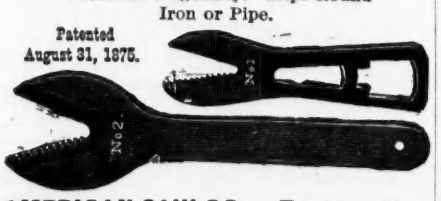

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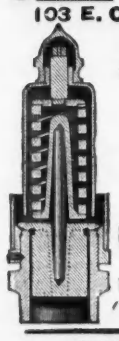

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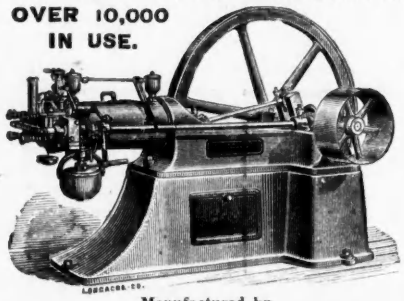

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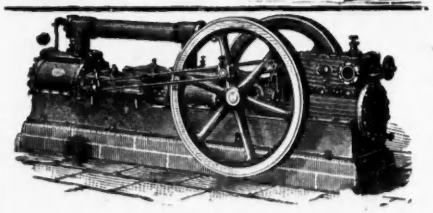

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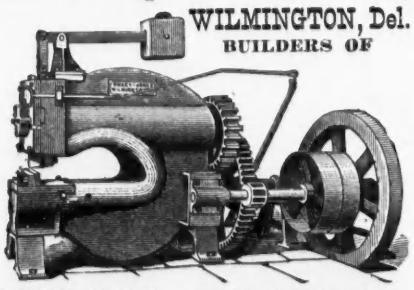

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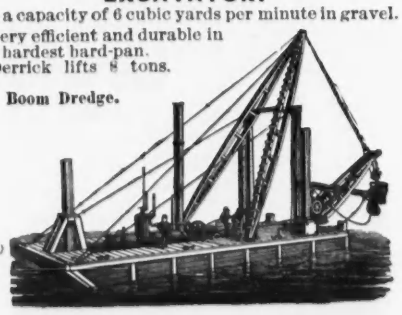

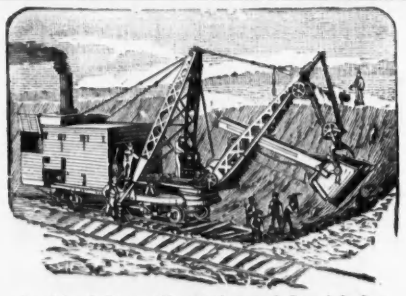

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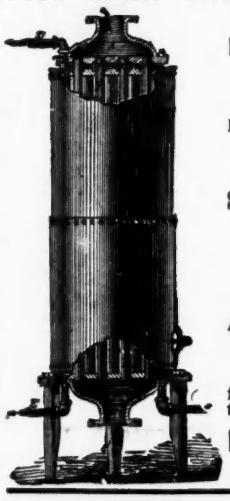

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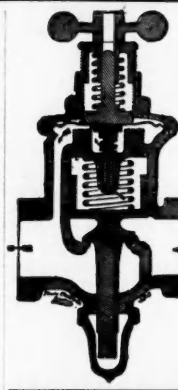

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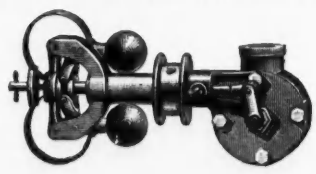

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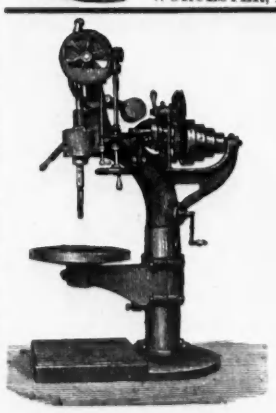

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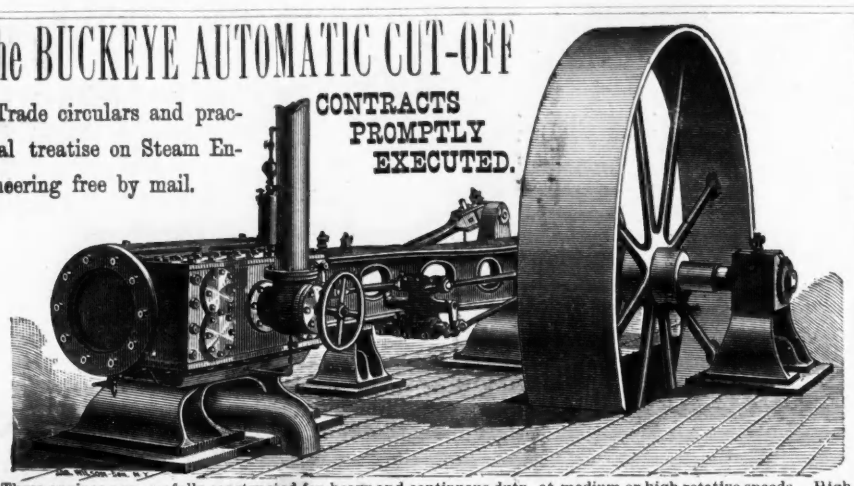

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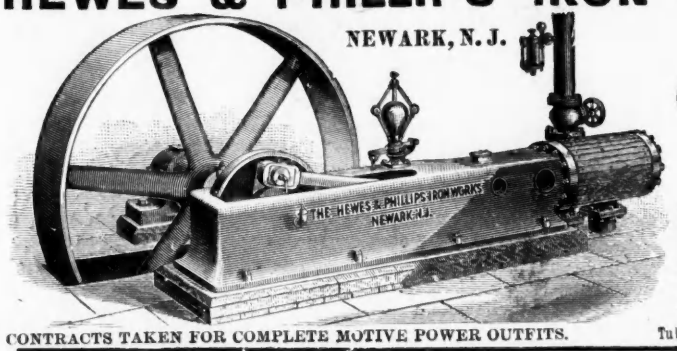

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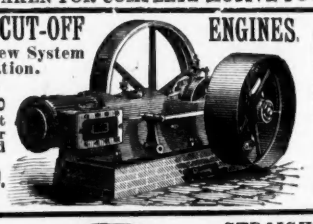

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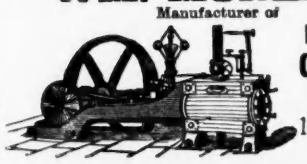

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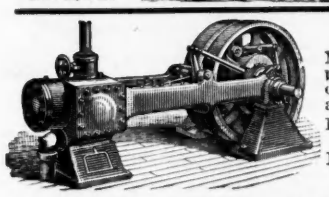

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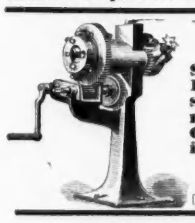

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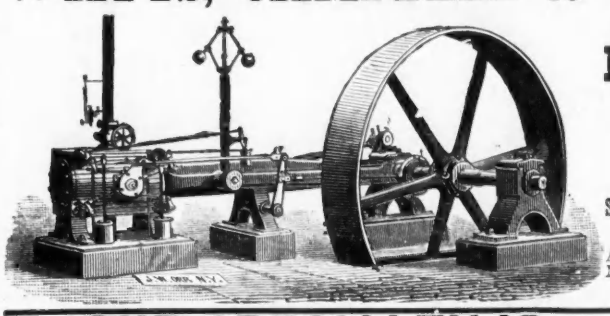

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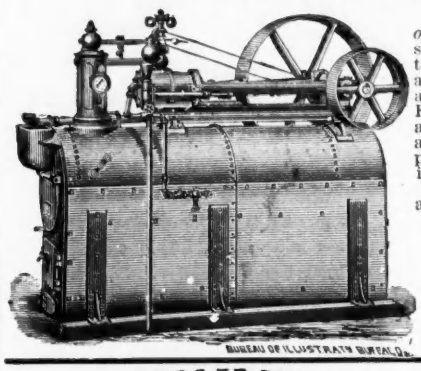

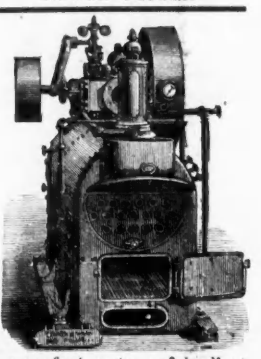

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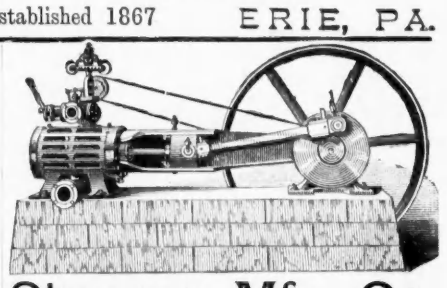

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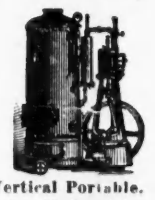

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One Engine Lathe, each 8, 10 and 12 feet bed, 19 in swing.
One Engine Lathe, 12 feet bed, 20 in. swing.
Two Engine Lathes, 8 feet bed, 18 in. swing.
One " each 6 and 8 feet bed, 16 in swing.
One Engine Lathe, 5 feet bed, 11 in. swing.
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Two Iron Planers, to plane 8 feet, 30 x 30 in.
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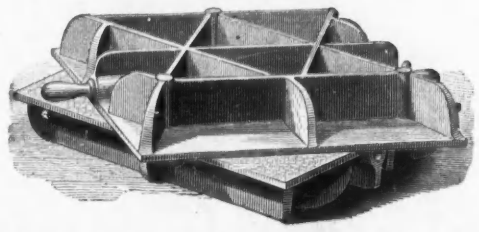

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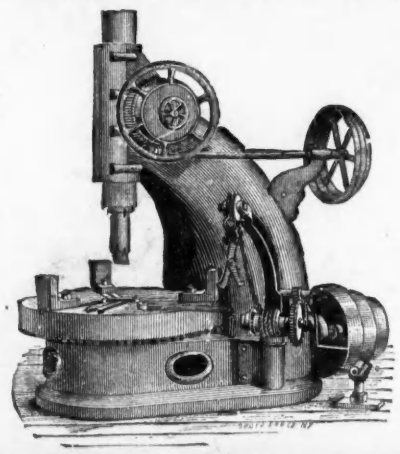

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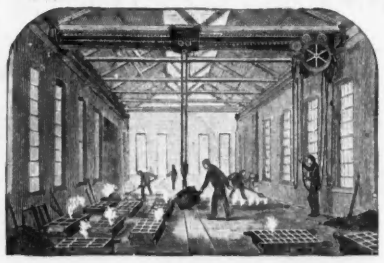

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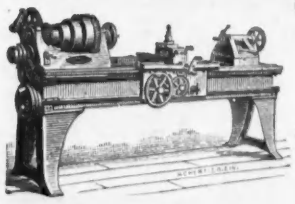

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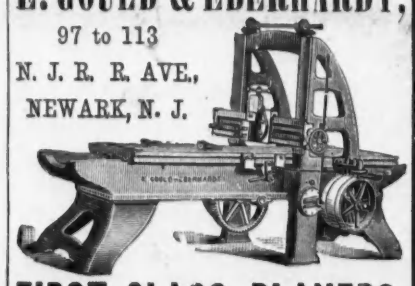

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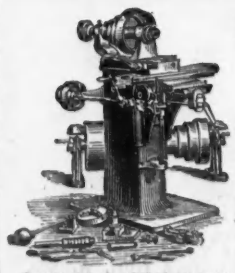

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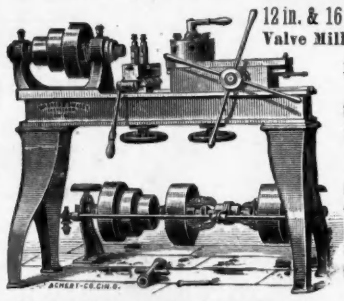

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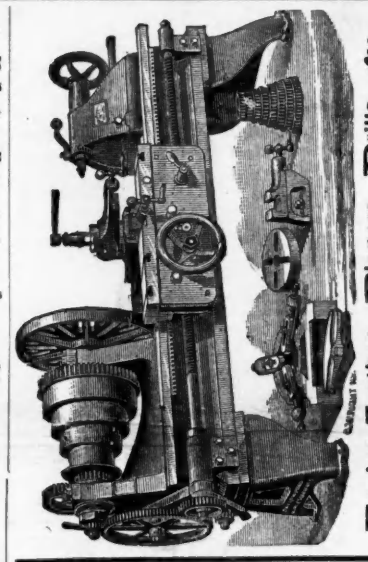

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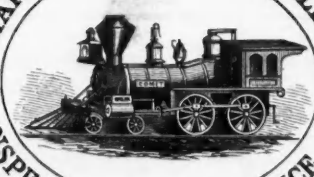

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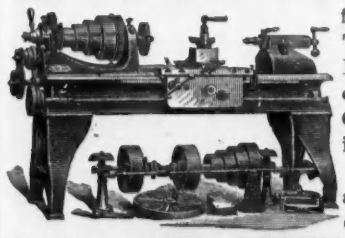

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